ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 19, No. 7. WEEKLY. | NEW YORK, SATURDAY, OCTOBER 10, 1891. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1891, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

The Chinese language is said to be best adapted to telephonic conversation, because it is monosyllabic.

Fitzgerald Murphy, who will star in an Irish drama called "Neil Agrah," was formerly a New York reporter. Two years ago he obtained employment as a telegraph messenger boy in the Twenty-third street district messenger station. After spending a week running calls, matching pennies and talking in the vernacular with the messenger boys, he resigned and wrote up his experiences in a page article for a New York paper.

A Texas lineman who survived a 500 volt shock thus describes his sensations:

"Just as the shock came, it seemed to me like a blinding flash of lightning had come and its lurid flame had struck and remained in my eyes. I then felt myself reaching upward and as though I was going to fly; this, I suppose, must have been the sensation caused by the contraction of my muscles. Then I felt as though I was soaring away, just as one feels when put under the influence of ether or chloroform. Then all was blank and I knew no more until I felt a pricking sensation in all of my members. I then felt a strong taste of brimstone in my mouth, just as I am told that those who are struck by lightning experience always."

An American gentlemen, who is an intimate friend of Madame Adelina Patti-Nicolini, has just returned from a visit to the fairy castle of the famous singer, at Craigy-Nos, near Swansea, Wales. "Now, that I am back in America," said he, "my visit seems a dream. Such luxury and wealth I never before witnessed. The castle is lighted by electricity, electric motors are used wherever possible, and private telegraph and long-distance telephone lines connect the castle with London. In the billiard room is a $30,000 orchestrion operated by electricity. It is as delicate as a human voice and very often the maker is summoned by telegraph from Germany to adjust it. The new theatre which Patti has just built near the castle will accommodate 300 people and is a little gem. It has the regulation slanting floor, but this is so arranged that it can be raised or lowered to any desired position by means of electric motors. The electric light and power station is a handsome stone building situated at a little distance from the castle. A most complete system of electric burglar alarms protects the castle from uninvited intruders."

The taking of testimony in the suit of the Thomson-Houston Electric Company *vs.* the Edison Company, in which the patents on the three-wire system of distribution are in dispute, is nearly completed and the case will soon be argued.

Two men at Spokane, Wash., were recently arrested for stealing incandescent lamps. It developed that they were opium fiends and had been stealing and selling lamps for three months. The money they obtained went for "dope."

A special sub-committee of the Allegheny, Pa., sub-committee on public lighting has negatively recommended the proposition to abolish the use of electricity and return to the use of gas for lighting the city. A proposition from the Allegheny Gas Company was returned to the general committee. The Fort Wayne Electric Company offered to furnish 60 arc light dynamos and attachments, worth $5,000, for a trial of 90 days free of cost. Superintendent Hunter was authorized to solicit similar proposals from the Thomson-Houston and the Brush Electric Light Companies.

FIG. 1.—VIEW IN THE MACHINERY HALL OF THE INTERNATIONAL ELECTRICAL EXHIBITION AT FRANKFORT-ON-THE-MAIN.—FROM A PHOTOGRAPH TAKEN BY OUR SPECIAL CORRESPONDENT.

ELECTRICAL PROGRESS IN GERMANY.

International Electro-Technical Exhibition at Frankfort-on-the-Main. —The Electrical Congress.

DR. HERTZ'S AND OTHER EXHIBITS ILLUSTRATED AND DESCRIBED.

Although the Frankfort Exhibition was formally opened on May 16, in the presence of the Empress and high state officials, it has not reached approximate completeness until within the last week or so. The ELECTRICAL REVIEW has had a correspondent on the ground for some time, and in this issue we present a number of illustrations and descriptions of several of the exhibits. All the enterprise and newspaper push of our correspondent was required to secure these illustrations, as the photograph privileges are surrounded by stringent rules—however, the pictures are here. In view of the interest taken in Professor Hertz's work by American scientists, the illustration of his exhibit will be of more than passing interest. Our correspondent at Frankfort writes as follows, under date of September 12:

The date originally fixed for the opening of the Frankfort Exhibition was June, 1890, but it was found that many of the principal exhibitors would be unable to complete their displays in time, and by mutual consent the Exhibition was postponed a year. The work on the buildings was begun in December last, but owing to a long, severe Winter, which froze the ground to a great depth, and a hurricane which blew down the framework of the main machinery hall one night in January last, a long and vexatious delay was caused. The entire Exhibition with all its adjuncts is lodged in new buildings, constructed especially for their present purposes upon rough broken ground, which had been previously occupied by railway tracks, and required elaborate and expensive preparation; but in spite of all delays, the buildings were practically prepared for the reception of all exhibits on May 1, and it has taken the intervening time between May 1 to the present time to properly prepare the exhibits, so that now the display is approximately complete.

There are assembled in this Exhibition motors aggregating about 5,000 horse-power. The size of the display may be more readily appreciated when it is stated that the electrical exhibition at Munich, in 1882, employed motors of 160 aggregate horse-power; the Vienna Exhibition of 1883, 1,200 horse-power; while at the Paris Exhibition of 1889, a large department of the machinery hall was devoted to electricity as applied to a large group of industries.

The Exhibition plant comprises nine principal buildings, each of which is devoted to a definite class of exhibits. These are as follows: 1st, the main machinery building for steam and gas engines, dynamos, etc., with an annex for steam boilers; 2nd, department of medicine and surgery; 3d, telegraphy and telephony; 4th, electro-chemistry; 5th, railway appliances; 6th, electro-galvanism and metallurgy; 7th, electric installations and distribution systems; 8th, marine station and lighthouse; 9th, electrical navigation. Besides these there is an extensive series of workshops equipped with electrical appliances for all classes of mechanical work, and an underground department where there is exhibited electrical machinery for mining and quarrying. Finally, there is a completely equipped theatre, where ballet and other performances are given each afternoon and evening, for the purpose of showing what can be done with electricity in producing dramatic and spectacular effects.

There are in all 493 exhibitors, a number of whom have exhibits in several departments. Of course, a large majority of the exhibitors are the Germans; next in order of numbers comes Austria, then Great Britain, the United States, Switzerland, Italy, Russia and France.

Although the American display is small, comparatively speaking, still everything shown is unique and represents a new idea. The distinctively American exhibitors and the products which they present are as follows: Otis Brothers, New York, Otis electric elevator; Babcock & Wilcox Company, New York, tubular safety-boiler; American Link Belt Company, New York, link belting; Edison United Phonograph Company, Edison's phonographs, operated by primary batteries, accumulators and machine currents; Weston Electrical Instrument Company, Newark, N. J., measuring instruments; Singer Sewing Machine Company, sewing machines operated by electric motors, and the Thomson-Houston International Electric Company, with nine exhibits in four departments.

The phonograph and the long distance telephone seem to be the most attractive features of the Exhibition as regards the general public. Special rooms are fitted up with telephonic communication with the opera houses at Munich and the Kursaal at Wiesbaden, so that the daily performances at those places are enjoyed by wondering audiences at the Frankfort Exhibition.

Consul-General Mason, in a recently transmitted report, writes as follows:

"It has been stated in previous reports on the present topic that this Exhibition of 1891 is expected to furnish some definite conclusions upon two points of extraordinary practical interest, viz., the comparative merits of all the known methods of electric propulsion for railway cars, with the storage system, upon which the use of electric power for marine purposes mainly depends, and, finally, the problem of long distance transmission of electric energy. The first comprises the whole subject of production, storage and distribution of electric energy; in short, a comparison of the several competing systems, which will here be brought into open rivalry under the eyes of an international jury of the highest authority and competence. There are hundreds of municipalities, street railway companies and manufacturing firms, in Germany, which are on the point of adopting electricity for motive or illuminating purposes and are waiting for the result of this competition before deciding where to place their contracts. The verdict of this trial will make the fortunes of the successful contestants."

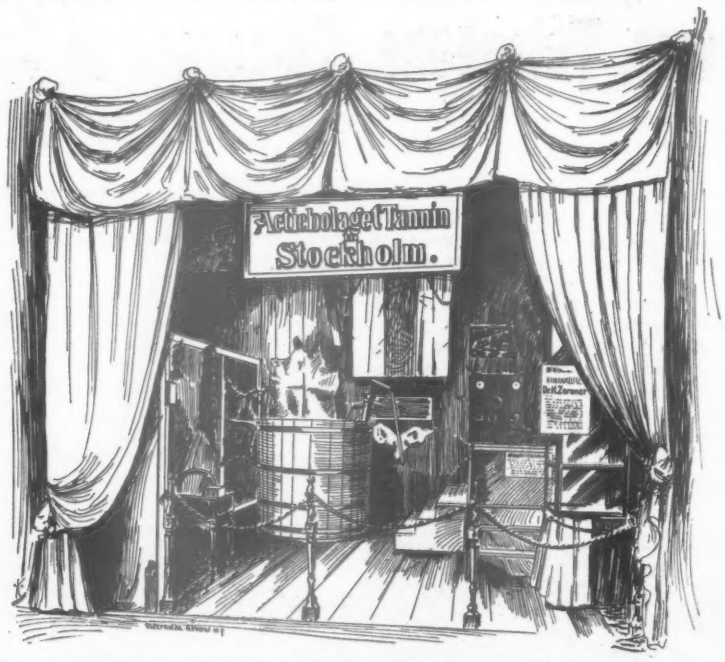


FIG. 3.—DR. ZERENER'S ELECTRICAL TANNING EXHIBIT AT THE FRANKFORT ELECTRICAL EXHIBITION.—SKETCH FROM PHOTOGRAPH BY OUR CORRESPONDENT.

In Fig. 1 of the illustrations is shown an interior view of Machinery Hall; Fig. 2 shows a group of small buildings outside the large building; in Fig. 4 Dr. Hertz's exhibit is shown; in Fig. 3 is shown the exhibit of H. Zerener, relating to electrical tanning.

The illustration, Fig. 4, shows an exhibit, in a special department of the International Exposition, of the famous apparatus used by Professor Hertz in his experiments for demonstrating electrical radiation.

One of the pieces of apparatus is a wooden frame with thin wires mounted thereon to prove the polarization of electrical rays.

Another one is the asphalt prism for demonstrating the refraction of electrical rays. A paraffine block is also shown, which was used for proving the induction by electrical displacement.

The electric batteries and induction coil are shown in connection with two parabolic mirrors of zinc about seven feet high. In the focus of one of the mirrors are located the electrodes of the secondary coil. In the back of the other prism is an adjustment for reproducing the spark after the deflection through the prism has been effected.

The process of tanning by electricity is shown at the Exposition by Dr. H. Zerener, of Stockholm; Fig. 3, gives some idea of his exhibit. The current used in the process is an alternating current. After the mechanical work upon hides has been done, such as removing the hair, etc., the filling up of the pores is done by an electrical process. This is not supposed to be an electrolytic action, since an alternating current is used. The greater the number of alternations the more favorable the action. The number of alternations used in the process, as exhibited at Frankfort, is 60 per second, while the proprietors claim 100 alternations would give better results. The hides are hung over wooden sticks, parallel to one another, and the current is applied to two copper or zinc sheets (either can be used), which are of the full size of the tank in which the hides are hung. The whole current is then sent through the solution, which has been prepared in the ordinary way. The time required when electricity is used is only one-tenth of that in which only mechanical methods are adopted, although the solutions, hides, etc., are the same in each case. The voltage used depends upon the length of the tank, and the average current applied per square metre is seven amperes. The voltage used in this case with best results is from 21 to 22 volts. The theory is that on account of the alternating current the fibres and molecules are brought into such vibration as to propagate the action and allow the solution to enter and fill the pores of the hides. The tanks can be connected in series or in parallel.

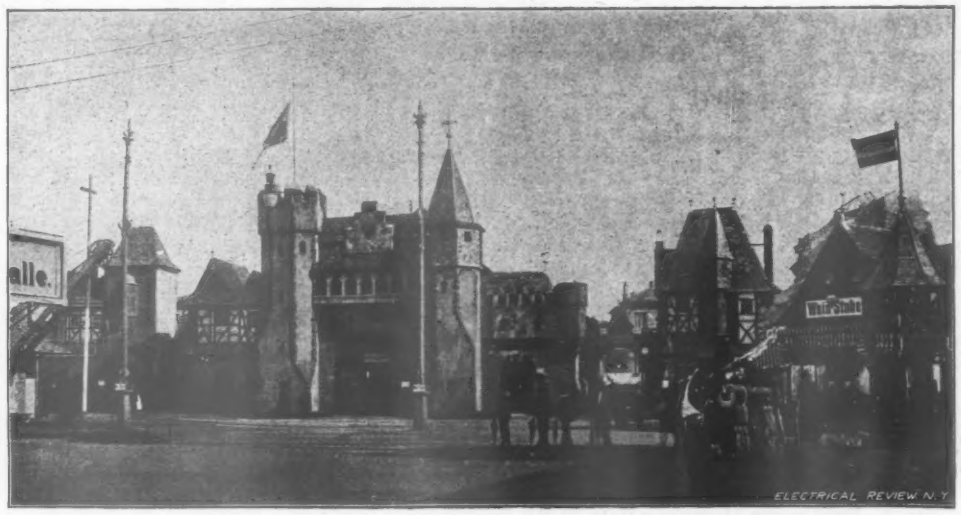


FIG. 2.—VIEW IN THE GROUNDS OF THE FRANKFORT ELECTRICAL EXHIBITION.—FROM PHOTOGRAPH BY OUR CORRESPONDENT.

OFFICIAL PROGRAMME OF THE INTERNATIONAL ELECTRO-TECHNICAL CONGRESS AT FRANKFORT-ON-THE-MAIN, FROM SEPTEMBER 7 UNTIL SEPTEMBER 12, 1891.

HONORARY PRESIDENT, DR. P. VON STEPHAN, OF BERLIN, POSTMASTER-GENERAL OF THE GERMAN EMPIRE.

MONDAY, SEPTEMBER 7.

8 P. M., Reception of the members in the hall of the grand restaurant on the Exhibition grounds.

TUESDAY, SEPTEMBER 8.

9.30 A. M., Breakfast in the restaurant and first general session.
12 M., Continuation of session and dinner.
4 P. M., Meeting of Sections I, II and III in different localities assigned.
6.30 P. M., Reception in the Victoria Theatre.
8 P. M., Supper in the private rooms of the grand restaurant.
10 P. M., Inspection of the illumination of the grottos and waterfalls.

WEDNESDAY, SEPTEMBER 9.

9 A. M., Session of Section I in the auditorium of the Physical Association.
11 A. M to 1 P. M., Session of Section III in the upper hall of the Bürgerbräu. Breakfast or dinner, according to choice.
2 P. M., Session of Section II in the great adjunct hall of the restaurant.
5 P. M., Festival dinner in the great hall of the Palmengartens.
8 P. M., Promenade concert in the Palmengartens.

THURSDAY, SEPTEMBER 10.

9.30 A. M., Second general session in the Victoria Theatre.
11.30 A. M., Breakfast in the grand restaurant.
12 M., Continuation of the second general session and dinner.
4 P. M., Session of Section IV in the small adjunct hall of the restaurant.
7.30 P. M., Festival of the marine exhibition. Illumination of the shore of the river Main. Naval procession of the singing societies. Parade of the four Frankfort marine associations and general assembly at the exhibition in the reserved terrace of the grand restaurant.
8.30 P. M., Vocal concert on the terrace by the vocal society of the Frankfort Teachers' Association.

FRIDAY, SEPTEMBER 11.

9 A. M., Session of Section II in the adjunct hall of the restaurant.
11 A. M., Session of Section III in the upper hall of the Bürgerbräu. Breakfast or dinner.
3 P. M., Session of Section I in the auditorium of the Physical Association.
6.30 P. M., Gala performance in the Opera House.
9 P. M., Meeting in the hall of the new Exchange offered by the Electro-Technical Association of Frankfort for the celebration of its thirteenth anniversary.

SATURDAY, SEPTEMBER 12.

9.30 A. M., Third general meeting in the Victoria Theatre.
11.30 A. M., Breakfast in the restaurant.
12 M., Continuation of the third general meeting. Dinner.
3 P. M., Sessions of Sections I, II and III.
7 P. M., Evening entertainment and dancing in the zoological gardens.

SUNDAY, SEPTEMBER 13.

Excursion to Wiesbaden with special trains.
Evening, grand garden reception in the Cur Park, with brilliant fire-works, under direction of the city of Wiesbaden.

MONDAY, SEPTEMBER 14.

Excursion to Lauffen on the river Neckar.

PAPERS TO BE READ—GENERAL SESSION.

1. Dr. Epstein, of Frankfort—"Requirements of Institutions for Electrical Researches."
2. Prof. E. Hospitalier, Paris—"Electro-Technical Notations, Conventions and Symbols."
3. Prof. Dr. Wilhelm Kohlrausch, of Hanover—"What is the proper course of studies for an Electro-Techniker?"
4. Director Dr. Loewenherz, Charlottenburg—"The introduction of improved screw threads for

electro-technical and refined mechanical contrivances."

5. Dr. Oscar May, Frankfort—"Rules for the Construction of Electric Conductors, from the standpoint of Fire Insurance Companies."

6. Prof. Dr. Silvanus P. Thompson, London—"The New Domain of Alternating Currents."

7. Karl Zipernowski, head engineer of the firm of Ganz & Cie—"Electric Railways for Rapid Suburban Transportation."

FIRST SECTION.—THEORY AND MEASUREMENTS.

1. Dr. Du Bois, Berlin—"Magnetic Fields and Their Measurements."

2. Dr. Bruger, Frankfort—"The Application of Measuring Instruments for Alternate Currents."

3. Dr. Karl Feussner, Charlottenburg—"The Material and Construction of Measuring Instruments."

4. Carl Hochenegg, of the firm of Siemens and Halske, Vienna—"Graphic Investigations of Electric Conductors."

5. Dr. Holborn, Charlottenburg—"The Magnetic Capacity of Various Iron Alloys."

6. Dr. Kahle, Charlottenburg—"The Allowable Limits of Errors in Measuring Instruments." (Heat, residual, etc.)

FIG. 4.—DR. HERTZ'S WONDERFUL EXHIBIT AT THE FRANKFORT ELECTRICAL EXHIBITION. (FROM PHOTOGRAPH BY OUR CORRESPONDENT).

7. Dr. Koepsel, Charlottenburg—"The Present Condition of the Technic of Measuring."

8. Dr. Lindeck—"Normal Elements."

9. Professor Möller, Braunschweig—"Stationary and Moving Energy, a Fundamental Theorem of Dynamics."

10. Professor Peuckert, Braunschweig—"The Question of Electricity Counters."

11. Prof. Dr. Quincke, Heidelberg—"A New Form of Electro-Magnetic Measuring Instruments."

12. Prof. Dr. Voller, Hamburg—"Proposal of a Method to Demonstrate and Investigate Electric Waves and Wires."

13. Prof. Dr. Weber, Zurich—"General Theory of the Incandescent Electric Lamp."

SECOND SECTION.—TECHNIC OF HIGH TENSION CURRENTS.

1. Engineer Baumgardt, Dresden—"The Economic Relations Between Atmospheric Pressure and Electricity."

2. M. v. Dolivo Dobrowolsky, Berlin—"The Electric Transmission of Power by Alternate Currents."

3. E. H. Geist, Cologne—"Electric Machine with a Contrivance to Measure Mechanical Power."

4. N. Georges, engineer of the firm of Siemens and Halske, Charlottenburg—"Communications about Novel Researches of Alternate Current Motors."

5. Dr. C. Heim, Hanover—"The Testing of Accumulators."

6. Hummel, Neuremberg—"Determination of the Magnetic and Electric Current Work in Horseshoe Irons."

7. Gisbert Kapp, London—"Experimental Determinations of Losses by Foucault Currents and Hysteresis in Dynamos, as well without as by full charge."

8. Wilh. Lehmeyer, Frankfort—"Novel Constructions in the Field of Alternate and Direct Currents."

9. Adolph Muller, Hagen—"Shunting of Accumulators for Small and for Large Plants."

10. Dr. F. Schulze-Bergen, of Edison's Laboratory, Orange—"Rotary Air Pump for Attaining very High Rarefication."

11. Professor Wilking, Berlin—"Accumulation by Alternate Currents."

THIRD SECTION—SIGNALING, TELEGRAPHY AND TELEPHONY.

1. Bauman, Munich—1. "The Prevention of Disturbances of the Telephonic Correspondence by High Tension Currents." 2. "Communications about Terrestrial Currents."

2. Emanuel Berg, Berlin—"Application of Electro-technic upon Navigation."

3. Postmaster Grawinkel, Berlin—"Currents Obtained by Accumulators."

4. Baurath Kareis, Vienna—1. "Prevention of Cross-talk by Telephone Wires Stretched on the Same Poles." 2. "Improvements in the Conductivity of Telegraphic Conductors."

5. Dr. Julius Maier, London—"Government or Private Control of Telephonic Conductors."

6. Dr. Meissner, Gottingen—"Application of Lippman's Capillar-Electrometers to Cable Telegraphy."

7. W. H. Preece, London—"The Recent Progress of Telegraphy and Telephony in England."

8. Dr. Strecker, Berlin—"A Telephonic Measurement of Time."

9. Prof. Silvanus P. Thompson, London—"The Phonopore: An Instrument for the Simultaneous Utilization of Telegraph and Railway Signal Lines for the Purpose of Multiplex Telegraphy and of Simultaneous Telephony."

10. Prof. Dr. Ulbricht, Dresden—"Combination of Current, Sub-division in Cities With Central Clock Work."

FOURTH SECTION.—ELECTRO-CHEMISTRY AND PECULIAR APPLICATIONS OF ELECTRIC CURRENTS.

1. Dr. C. Hoepfner, Giessen—"Electro-Chemistry and Electro-Metallurgy."

2. Dr. Otten, Hamburg—"The Application of Electricity to Mining, with Peculiar Regard of the Latest Experiences of Van Depoele."

3. Prof. Silvanus P. Thompson, London—"Electric Machine Tools for Mining."

4. Dr. Zerener—"Electric Tanning."

FIFTH SECTION.

It will be proposed to establish a new section for the establishment of first principles upon which electro-technic laws could be founded, especially in regard to the relation between low and high tension current plants.

A Large Shipment.

The Berlin Iron Bridge Company, of East Berlin, Conn., on Saturday, September 26, shipped 23 car loads of iron building material at one shipment by a special train over the N. Y., N. H. & H. R. R., for the Companhia Nacional de Fojas e Estaleiros, Rio de Janeiro, Brazil, S. A.

This shipment is one of the largest single shipments that ever passed through New England, the combined weight of the 23 cars being nearly 1,000,000 pounds. This shipment goes to Harlem River station, New York, and is there lightered aboard a Brazilian steamer and shipped direct to Rio de Janeiro.

This building is for a car works for the Companhia Nacional de Fojas e Estaleiros. Not only the building is to be furnished in this country, but also all the tools and machinery for the entire equipment.

Chicago, Ill.—Europe-American Electric Corporation; to acquire and dispose of electric patents; capital, $2,000,000; incorporators, Frank Butterworth, M. L. Willard and A. A. Bliss.

Elizabeth, N. J.—Elizabeth Manufacturing Company; capital, $100,000; to manufacture electrical and mechanical apparatus at Elizabeth and Plainfield. Address, Asa D. Philips, Plainfield.

Gormania, W. Va.—A charter has been granted to the Dobbin and Gormania Telephone Company, which is incorporated to connect these towns by telephone and to extend its line to Oakland, Md. The office will be at Gormania. The capital is $300, with the privilege of increasing to $10,000. J. L. Rumberger, of Dobbin, W. Va., and others are the incorporators.

Creston, Ia.—A new electric light company has been organized and expects to put in an electric light plant at once. The following will be the officers of the company: President, F. L. Macker; vice-president, W. A. Tipton; treasurer, C. A. Neimeyer; secretary and manager, A. H. Spurr; board of directors, J. B. Schnauber, A. M. Beecher, F. A. Spurr, C. A. Neimeyer and A. H. Spurr.

Attica, N. Y.—A new local company, incorporated under the name of the Attica Electric Light and Power Company, has purchased the property of the Thomson-Houston Company at Attica. The incorporators and directors for the first year are as follows: Andrew Krauss, Lewis Benedict, Joseph Bork, F. R. Danley and E. B. Wallis. The capital stock of the new company is $20,000.

Winchester, N. S.—A company styled the Ashuelet Valley Electric Lighting, Heating & Power Company has been formed at Winchester and will take measures to restore the electric lights with as little delay as possible. The new company has contracted with the selectmen to furnish lights for the town at $1,500 a year, and it is also expected to supply the tannery, hotel and other private parties as well.

Boston, Mass.—The Whitney Electrical Instrument Company, of Boston, has been incorporated to manufacture the electrical inventions of Messrs. E. C. Whitney and A. H. Hoyt. The company is organized under the laws of the State of Maine. Its principal stockholders are members of the Gould & Watson Company, manufacturers of electrical specialties and mica for various electrical purposes, Hartford street, Boston. Advices from Concord, N. H., under date of September 23, state that "The Whitney Electrical Instrument Company will soon begin the erection of a large three-story factory on the Contoocook River, in Penacook, N. H.," not far distant from Concord. The offices and factory of the company named, temporarily, will be at the Gould & Watson building, at address above given.

Graphite in Electrical Use.

It is probable that there are many expert electricians who have but a small idea of the important part that graphite, sometimes called plumbago or black lead, plays in the electrical industry.

The Jos. Dixon Crucible Company, Jersey City, N. J., inform us that they make for several electrical companies graphite sticks, varying in resistance from one-half ohm to 100 ohms to the inch.

The Dixon Company also prepares for laboratory use a graphite 99 per cent. pure, and make to order from drawings sent them any number of curious articles in graphite, without having the faintest idea of what use they are to be put to.

Electrical companies are just beginning to realize the manifold uses that graphite in one form or another can be put to.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
W. I BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:
L. W. COLLINS, 435 "The Rookery."

EUROPEAN OFFICE:
CHARLES FFRENCH, Editor for Europe.
HOTEL VICTORIA,
Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.
Telegraphic Address: Ffrench, "Victoriola," London.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, OCT. 10, 1891.

CONTENTS.

	PAGE.
Views, News and Interviews	91
Electrical Progress in Germany	91
A Large Shipment	93
New Corporations	93
Graphite in Electrical Use	93
Gerrycide Officially Defined	94
Novel Uses of Incandescent Lamps.—"A Flash of Darkness"	94
Science and Dinners	95
Correspondence:	
Our Boston Letter	95
Our St. Louis Letter	95
Our Chicago Letter	95
Our Albany Letter	95
Telephonic News	96
Erie Telephone	96
Telephone Legislation	96
The Nassau Door-Bell Outfit	96
Queen's New Portable Galvanometers	96
Electricity on Shipboard	96
Personal	96
Edison Electric Dental Drill	96
The Lauffen-Frankfort Power Transmission	97
Telegraphic	97
The Chinese Don't Like the Telegraph	97
Electric Power	98
Tests of the Short "Gearless" Motor	98
The Short "Gearless" Motor	98
"Steam"	98
Direct Coupled Multipolar Generator	99
Electrical Heating	99
Electric Light News	99
General Notes	99
Recent Progress in the Use of Electric Motors	100
Seller's Patent Water Tube Steam Boiler	100
The Weston Automatic Engine	101
The Air Gap in Dynamos	101
A Valuable Device	102
Messages sent to London and Replies Received in Four Minutes	103
A New Trade-Mark	103
Electric Lighting in Coal Mines	103
Westinghouse	103
A Quick Telephone Removal	103
The Bernstein Waterproof Socket	103
A Solution of the Block Signal Problem	104
Bain Complete Electric Light Plant	104
Literary	104
A Novel Electric Railway for the World's Fair Grounds	105
Book Review	105
Reflectors and Electroliers	105
Editor Bennett Doesn't Like Dolls	105
Kindred Interests	106
Electrical Patents	106

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Ansonia Brass & Copper Co.	xx
Armington & Sims	xx
Baker & Co.	xx
Brush Electric Co.	xix
Bridgeport Brass Co.	xix
Day's Kerite Insulated Wires	xix
Eastern Electric Cable Co.	xix
Hampson & Co., E. P.	xix
Jewell Belting Co.	xix
Keasbey, Robert A.	xix
Moore, Alfred F.	xix
National Electric Mfg. Co.	ii
Okonite Co	xix
Schuyler Electric Co.	xix
Standard Underground Cable Co.	xx
Wainwright Mfg. Co.	xix
Wilmot & Hobbs Mfg. Co.	xx

INSIDE PAGES.

Alexander, Barney & Chapin	v
American Bell Telephone Co.	ix
American Casualty Insurance and Security Co	v
American Circular Loom Co.	ix
American Electrical Works	xi
American Electric Elevator Co.	iv
Ball Engine Co	v
Ball & Wood Co.	xvii
Barnes Co., W. F. & John	xvii
Belanger Freres	vii
Berlin Iron Bridge Co.	xi
Billings & Spencer Co.	xii
Bishop Gutta Percha Co.	v
Bridgeport Machine Tool Works	xvii
Brill, J. S., Co.	xvi
Brownlee & Co.	vii
Buckeye Engine Co.	xii
Bunnell & Co., J. H.	106
Burton Electric Co.	xvi
Bush Co.	xii
"C. & C." Electric Motor Co.	v
Cary, Alanson	ix
Central Electric Co.	vii
Church & Sleight	ix
Claflin & Kimball	x
Consolidated Electric Mfg. Co.	xi
Copeland & Co., E. T.	xii
Cralle & Co., J. B.	viii
Crane Bros.	iii
Crocker-Wheeler Electric Motor Co.	xvii
Crosby Steam Gage & Valve Co.	v
Dixon Crucible Co	xii
Dwight Slate Machine Co.	ix
Edison General Electric Co.	vi & viii
Electrical Engineering Co.	106
Electric Construction & Supply Co.	xiii
Electric Secret Service Co.	xiv
Electro-Light Engraving Co	xii
Elektron Mfg. Co.	vi
Empire China Works	v
Equitable Engineering & Construction Co.	xii
Evans Friction Cone Co.	x
Falls Rivet & Machine Co.	iii
Faraday Carbon Co.	xiv
Fletcher & Fletcher Electric Co.	ix
Fort Wayne Electric Co.	xviii
Foundry and Machine Department, Harrisburg Car Mfg. Co.	xiv
Frink, I. P.	106
Garvin Machine Co.	xvii
Globe Co.	xii
Gordon & Co., W. H.	xiv
Greeley & Co., The E. S.	viii & ix
Haines, Jones & Cadbury	iv
Holmes, Booth & Haydens	vii
Imperial Porcelain Works	iii
Independent Bung Co.	iv
Johns Mfg. Co., H. W	x
Kulp, D. H.	viii
Ladd, Alfred W.	xvi
Lane & Bodley Co.	viii
Law Telephone Co.	106
Leclanche Battery Co.	xi
Leffel & Co., James	v
Lehigh Valley Creosoting Co	ix
Leonard & Co., H. Ward	viii
Marshall, Wm.	ix
McCreary Electrical Specialty Co.	iii
McGiffert, James B.	106
National Carbon Co.	xii
National Electrical Mfg. Co.	xviii
New England Butt Co.	xvi
New York and Ohio Co.	xii
New York Belting and Packing Co.	xvi
New York Insulated Wire Co.	viii
New York Safety Steam Power Co.	xvii
Noye Mfg. Co., John T.	xvi
Ostrander & Co., W. R.	xvi
Paiste, H. T.	xi
Parker-Russell Mining and Mfg. Co.	v
Partrick & Carter Co.	x
Phœnix Glass Co.	iv
Phosphor-Bronze Smelting Co., Ltd	xiv
Pond Engineering Co.	xi
Prentiss Tool & Supply Co.	106
Queen & Co.	xi
R. I. Telephone and Electric Co.	106
Reddaway & Co., F.	xiv
Ridlon & Co., Frank	106
Roebling's Sons Co., John A.	iii
Rollason Gas Engine Co.	xii
Royce & Marean	xvi
Russell Electric Co.	x
Santley & Co., W. R.	iv
Sawyer-Man Electric Co.	iv
Schieren & Co., Chas. A	106
Shipman Engine Co.	ix
Sigourney Tool Co.	xi
Solar Carbon and Mfg. Co.	v
Sperry Electric Mining Machine Co.	xi
Standard Paint Co.	xiv
Stanley Electric Mfg. Co.	xi
Star Electrix Co.	iii
Stephenson Co., John	xvii
Tropical American Telephone Co.	iv
Truex & Vail	viii
United States Electric Lighting Co.	xiii
Universal Arc Lamp Co.	x
Waddell-Entz Electric Co.	xii
Washburn & Moen Manufacturing Co.	ix
Watson & Stillman	ix
Western Electric Co	ix
Weston Electrical Instrument Co.	viii
Whitmore & Robinson	x
Williams & Potter	iv
Woodhouse & Rawson	ix
Wyckoff, Seamans & Benedict	106

The Frankfort Electrical Exposition is interestingly presented in the REVIEW this week. So are several other things.

The REVIEW's correspondent at Frankfort writes that: "The discussion on the 'Henry' unit was very warm. It was opposed by Dr. Siemens and several others, who seemed to think it was best to consider the matter awhile longer before deciding on the 'Henry.' It will be settled probably at the World's Fair at Chicago in 1893."

The new German patent law went into effect October 1. Under this law German patents can be applied for at any time within three months after issue of an United States patent. This liberal feature will prove highly beneficial to American inventors, as under the old law of 1877 the German application had to be lodged prior to the issue of the United States patent. Poor inventors can now have an opportunity to safely effect commercial arrangements in this country, and realize something from their inventions before undergoing the expense of a German patent.

A useful and humanitarian application of the electric motor is that described in another column where an Edison motor is attached to a dentist's drill. One of the chiefest advantages of such a combination would seem to be that the jar to the operator's hand, consequent upon running a drill by foot power, is entirely eliminated. The dentist can probably do better and safer work, as he is able to concentrate his entire attention upon the jumping molar, if he uses this adaptation of electric power.

GERRYCIDE OFFICIALLY DEFINED.

The official report by Drs. Macdonald and Ward of the four electrical executions on July 7 was rendered on October 1. The report confirms the accounts of the ghastly character of the proceedings given by the press on July 7; 1,458 volts of alternating current were applied for 27 seconds to Slocum, "at the end of which time it was broken, but the pulse was still found to be beating strongly, and between one and two minutes later a noisy respiration was established with considerable regularity. The current was immediately re-applied and continued for 26¼ seconds." With this second effort the condemned was finally launched into eternity. The ill-success of this experiment was evidenced by a consultation of the medical gentlemen present, held before the second victim was brought in, so, in the words of the report, "the next execution was conducted a little differently." The current was applied to Smiler for 10 seconds "and then interrupted to allow of wetting the sponges, then was again made for 10 seconds, when again the sponges were wet and a third contact was made, lasting 10 seconds," and at the end of the last the pulse was beating so firmly and regularly that it was deemed expedient to again close the circuit for 19 seconds. Thus four times was an effort made to kill this man. It seems scarcely reasonable that in 10 seconds stoppage should be needed to "wet the sponges," so that this is probably a mere pretext to cover the horrible repetition of the efforts to kill. It seems scarcely possible the executioners could have been such scientific "chumps" as to apply an electrode which would fail to conduct the current after 10 seconds. With Wood three contacts of 20 seconds each were made. After this "feeling that the contacts had been unnecessarily prolonged, it was determined to make them a little shorter in the next case." The reason for this conclusion is not at all clear from the premises. In all three cases the current had to be several times re-applied, because death did not supervene and because "the sponges got dry." Much must evidently be read between the lines; the true inwardness of that day's doings, if it could be given in detail, would raise such a public protest as to prevent any further executions until this law is repealed. In Jugiro's case the current had to be applied three times of 20 seconds. A thermometer applied to the skin indicated 115 degrees. The report says the thermometer was held in contact only for 15 seconds. This was not long enough to get the true temperature. It is stated, "extreme heat was noticed in the region of the knee above the point where the lower electrode had been applied; the sensation it conveyed to the hand being such as to render it probable that the temperature had run up to the boiling point of water if not higher." In each case the temperature of the water in the electrodes was raised to the boiling point so as to blister the skin.

What a spectacle this for this humanitarian age! The public was told by defenders of this new system of punishment that the newspapers exaggerated it for sensational effect. Here is the official report of the medical men present, evidently coloring the affair in pale shades. Blistering and boiling are terms that were used in mediæval times by despots to paralyze men with fear. In those days it was honestly labeled torture, but a cultured modern civilization—of which Mr. Gerry aspires to be the exponent—by a feat of etymological legerdemain, euphemistically calls it *humane.*

NOVEL USES OF INCANDESCENT LAMPS.—"A FLASH OF DARKNESS."

A series of caricatures in one of the illustrated papers shows Uncle Hayseed in a New York hotel just before retiring. After ineffectual attempts to blow out an incandescent light, he eclipses it by means of a capacious boot which is inverted over the glowing bulb. The pleasantry of the artist indicates in truth and soberness the great change in methods of illumination resulting from the use of the incandescent light.

Although the complaint of the compositor in a printing office that he could not light his pipe from the incandescent lamps may be admitted as a hardship, yet this inability to produce a direct ignition, which does not exist in any other method of artificial illumination, permits the use of light beyond the hours of the sun in many dangerous processes, giving fuller employment to labor and extending the capacity of manufacturing plants.

There is scarcely an electric lighting installation in any manufacturing establishment whose service is not or cannot be made of especial value in some applications which are out of the usual course and may be peculiar to the individual conditions of the works.

A pair of wires along the wall back of the boilers, with fixtures near to each manhole, where a long flexible connection leading to a guarded incandescent lamp can be attached, affords a useful method of furnishing the light for examination of the interior of any of the boilers, or any night work so frequently necessary in such places.

A diver employed in repairing the dam of a mill reported to the manager during the afternoon that he would be obliged to stop work until the next day, as the shadow prevented him from seeing well enough to continue work. The man in charge of the electric lighting plant promised to furnish him with a light under water in a few minutes. A lamp with water-proof wires and connections was quickly arranged and lowered into the water, and by this means continuous work on the repairs was made possible and the stoppage of the works for another day prevented.

The use of a moving incandescent light to indicate the position of a passenger elevator is frequent; and a similar application for a more novel purpose is the use of an incandescent lamp in pumping stations as a target on the scale showing the height of the water in the pump well. During the day such a lamp serves in the same manner as the ordinary target on a card moved by the float in the water far below, while at night its illumination shows its own position and also lights up the scale.

The trap-doors in a theatre are so arranged that when any one of them is opened it moves the switch to an incandescent lamp in the place beneath.

Visitors at the Paris Exposition of 1889 will remember the model of the Suez Canal in one of the Egyptian buildings, where the topography of the country was made in contour and colored to resemble nature. Passing through a tortuous passage lined with black cloth, one entered a thoroughly darkened room; here was a duplicate model, in which the various lighthouses, semaphore signal towers and incandescent lamps, presented in a realistic manner a midnight *facsimile* of this remarkable canal.

One of the large electric lighting companies has in its office a map of the city drawn on a very large scale, and containing perforations showing the location of all outdoor electric lights. On the back of the map sheets of thin gelatine are secured at each hole—red gelatine being used for the lights furnished by the company in question, and different colors the lights of their principal competitors. Back of this map is a bank of incandescent lamps, and by the turning of a switch the position of the electric lights throughout the whole city is shown. The effect is rendered even more realistic by colored thread representing the courses of the various circuits.

The use of incandescent lamps in hospital

practice is of great benefit to mankind, not merely in the ordinary illumination of the wards without vitiation of the air, but in the facility with which lights with netting and on flexible connections can be used in night practice, as well as for special work, and also the capability of furnishing a larger illumination from a number of different directions, permitting the free performance of operations at night—a matter of great importance in city hospitals where a large number of surgical cases are received late at night.

But in a more homely way, one frequently sees at some mill or electric lighting station the use of incandescent lights in place of the time-honored hot teapot or the poultice for local aches and pains; and the sufferer from toothache or *tic doloreaux* finds that the ills of the flesh are relieved by the gentle counter irritant of an incandescent lamp wrapped in cloth.

The use of incandescent lights has almost entirely been confined to their practical application as a source of illumination, and as noted above it is sometimes used for the purpose of furnishing a gentle heat. But in one of the cold storage warehouses in Boston incandescent lights are used as a method of signaling to the various portions of the building, which are kept at a very low temperature and, therefore, entirely closed. A system of electric bell signals was used, but was not entirely satisfactory, on account of the vast size of the establishment and the use of many small rooms, in which the sound of the bell could not be heard by any one working therein. Dimming switches were, therefore, placed near the office in the branches leading to each floor, so that a resistance could be switched into any of the mains, momentarily reducing the illumination from every incandescent lamp on any floor; and a very few simple signals enables the person in charge of the establishment to communicate with those upon each floor by the sudden diminution of the light or, as one of the Hibernians employed in the establishment expressed it, "a flash of darkness."

The United States Fish Commission use a submerged incandescent lamp as a greater attraction to fishes than burnished metal or toothsome bait, and probably this is the only method of fishing which will never give rise to any discussion as to whether it is to be classified as pot-hunting or sport.

C. J. H. WOODBURY.

Science and Dinners.

Our readers will, no doubt, notice how in the Frankfort Exhibition programme the German character prevails in regard to combining science with pleasure as well as with social intercourse. When comparing with it our programmes of similar meetings it seems that we either totally disregard the material inner man, the man who needs regularly a supply of organic matter to keep the organisms of his brain in working condition, or sometimes only mention a recess for lunch, which the members may find each for themselves if they know where. Sometimes hospitable citizens give an occasional reception with refreshments, as is usually the case with the meeting of the American Association for the Advancement of Science, for instance, in Indianapolis last year; but in the recent Washington meeting even this was totally absent.

In Montreal, however, when the National Electric Light Association met recently, the citizens and the city authorities competed with each other to do honor to the foreigners, and entertained them. They made up to some extent for the omission of those who have charge of scientific programmes, who may take a lesson from our German neighbors, whose character is the reverse of Puritanism and Quakerism, which have influenced somewhat the American character in this respect.

Our scientific friends of the New York daily press have discovered a new primary battery of inestimable value. Before much of the stock of the company is purchased, tests made by a practical electrician or two should be required.

CORRESPONDENCE.

OUR BOSTON LETTER.

Mr. Fred. M. Kimball has been appointed manager of the supply department of the Edison Company's Eastern district.

Boston Electric Club will have its regular quarterly meeting at the Club rooms, Monday evening, October 5, at 8 o'clock.

Mr. A. H. Bullard, of the Bridgeport Machine Tool Works, was in this city recently and favored this office with a visit.

Messrs. F. W. Prescott & Company, bankers and brokers, this city, are actively engaged promoting and negotiating electrical stocks.

The Lewiston and Auburn, Me., Electric Light Company is installing in its station a new 2,000 light alternating current machine of the Westinghouse type.

Messrs. H. B. Prindle & Company have established themselves in business in this city at the Manufacturers' Advertising Agency, and occupy commodious offices at No. 53 State street.

The Willimantic, Conn., Gas Company has, it said, purchased the charter and entire business of the Willimantic Electric Light and Power Company, and work will be commenced at once on a new central station.

Mr. N. T. Starkey has handed in his resignation as manager of the electric street railway department of the Edison Company's Eastern district. This resignation took effect October 1, and Mr. Starkey's successor will be Mr. C. C. Pierce.

The Edison General Electric Company's New England department has again been compelled to increase its premises, and has leased the adjoining store, No. 23 Otis street, and will fit it up as offices and exhibition room for stationary motors.

Mr. Alphone Martin, superintendent for several years of the Belt Line Electric Railway, between Lynn, Mass., and Winthrop Junction, has tendered his resignation, and will become general manager of the Gloucester (Mass.) street railway.

Prospect of an Overhead Trolley System on the railroad between Beverly and Danvers, Mass., has assumed a favorable outlook. This road was, until recently, equipped with the storage battery system of the Union Electric Railway Company, of Boston.

The Russell Electric Company, of Boston, at their annual meeting, last week, in Portland, Me., elected the following gentlemen as directors for the ensuing year: A. W. Rounds, H. E. Chapman, A. N. Reynolds, H. W. Boyd, O. A. Willard, W. F. Robbins, F. H. Carpenter.

General Manager Benton, of the electric railway department of Detroit Electrical Works, has been in this city several days during the present week, and has made his headquarters at the offices of Messrs. Shaw & Ferguson, electrical engineers, Exchange building, State street.

The Abington and Rockland Electric Light and Power Company, of Rockland, reports that it will be ready to turn on current by December 1. The station is nearly completed and the entire equipment will be in position before November 15. Poles are up and the wiring is progressing rapidly.

Mr. Charles J. Van Depoele, the well known and much respected inventor and electrician, started for Chicago last Thursday evening immediately after receiving a telegram bearing the sad tidings that "Mr. Van Depoele's father is dying." The elder Mr. Van Depoele has been seriously ill for several weeks.

The Thomson-Houston Company has effected a sale of 500 motors to the West End Railroad Company. This is the largest number ever sold to a single concern. An agreement was also made whereby the Thomson-Houston Company is to be relieved from the maintenance of the overhead wires of the railway company after October 1.

The Page Belting Company, of Concord, N. H., through its Boston branch house—Mr. J. H. Burkhardt, manager—has closed a contract to furnish the Georgia Electric Light Company, Atlanta, Ga., with 225 feet of belting 48 inches in width. This handsome contract is one of several large orders for the popular Page belting received recently by the company named.

The Eastern Electrical Supply and Construction Company, of this city, held a meeting of its directors last week and elected the following named gentlemen as officers for the ensuing year, viz: President, Maybin W. Brown; vice-president, W. B. Ferguson; secretary and treasurer, Albert Otis Smith. Messrs. D. J. Hern and L. A. Dean were added to the board of directors.

The Consolidated Fibre Board and Leatheroid Company was recently incorporated under the laws of the State of Maine. It will acquire the business and assets of the Mousam Manufacturing Company and Leatherold Manufacturing Company, at Kennebunk and Poland, Maine, and Boston, Mass. Full particulars may be had by addressing Safe Deposit and Trust Company, 53 State street.

Electric Light Plant for Peabody, Mass.—Recent advices from above-named town under date of September 29, state: The last of a series of special town meetings to determine the matter of establishing a municipal electric plant was held this evening. Ordered, by a vote of 225 to 10, to establish a plant and $47,000 was appropriated for that purpose. A circuit of 120 arc lights will be established.

The Pettingell-Andrews Company has purchased a controlling interest in the H. E. Swift Electrical Manufacturing Company, of this city, yet the latter concern will continue its manufacturing business, under its corporate name, as heretofore. The following named gentlemen have been elected officers of the H. E. Swift Company, viz.: H. E. Swift, president; F. E. Pettingell, vice-president, and D. A. Andrews, Jr., secretary and treasurer.

The Boston News Bureau says that a cable has been received from London ordering six 50 light Thomson-Houston arc dynamos for lighting the station of the Midland Railway of England. This is an addition to thirteen 50 light arc machines, with lamps, heretofore purchased by the same corporation. The Thomson-Houston International Company, through which this business comes, is exporting electrical apparatus at the rate of over $1,000,000 a year. It has lately sold several hundred thousand dollars' worth of railway apparatus for points in South America and Australia.

The Shipman Engine continues to make rapid strides in public favor, and its list of sales—particularly among the electric light people—are steadily increasing. The Shipman Engine Company make a specialty of small engines of 1, 2, 4, 6, and 8 horse-power, for isolated electric light plants. In hundreds of places where these engines are used to drive dynamos they have given thorough satisfaction. No coal is required, therefore, neither boiler nor furnace needed. Only a very small space is required for a dynamo (or two) and a Shipman 8 horse-power engine. The offices of the Shipman Engine Company are at 227 Summer street, Boston.

The Wainwright Manufacturing Company of Mass., having offices in this city, report recent sales of its heaters as follows:

Reading and South Western Railway Company, Reading, Pa., one 300 horse-power.

East River Electric Light Company, New York, two 100 horse-power.

Denver, (Colo.) Electric Company, two 100 horse-power.

Toledo *Bee*, Ohio (Electric Light Plant), one 100 horse-power.

Home Electric Light Company, Tyrone, Pa., one 200 horse-power.

Schuylkill Electric Railway Company, Pottsville, Pa., one 300 horse-power.

Arbuckle, Ryan & Company, Toledo, for City Electric Light Plant, one 125 horse-power.

W. I. B.

Boston, Oct. 3, 1891.

OUR ST. LOUIS LETTER.

The Exposition opened in great style last month. The electrical exhibits in the basement, while not as numerous as last year, are very fair. The Southern, St. Louis, Emerson and Parker-Russell people are all very well represented.

Mr. Horatio Foster, the electrical expert, in charge of that branch of the New York census, has completed the special work necessary in St. Louis and has left for the East. While here he had occasion to examine all the large electric plants in this city.

The Lindell Railway has brought out a new car on its road which is a novelty. It consists of two 18-foot cars joined together. The platforms are removed, strong braces used to make the joint, and when completed the car has every appearance of a new 40-foot car. Double motors are used.

At the annual championship meet of the A. A. U., it has been decided to use the new electrical timing apparatus invented by the electrical expert at Washington University. One of the local amateur photographers has also designed an electrical photographing instrument for taking the finish in every race. It is thus hoped to get a perfect timing and judging method.

The streets of St. Louis are now nightly illuminated with hundreds of electric and gas lights. All the downtown thoroughfares are lined with many colored globes, and at every crossing large arches of varicolored lamps help to brighten the place at night. This is one of the many ways St. Louis has of entertaining the crowd which congregates here in Fair week. One of the many novel illumination features is the use the poles on the Washington avenue electric line have been put to. The poles are placed in the center of the street and are separated about 100 feet. On the cross-arm have been placed intricate scrolls and designs formed of gas and electric lights, making a very beautiful appearance down the whole street. Grant's monument is decorated with incandescent lamps, while a huge figure of the Goddess of Liberty, placed at the other end of the square, employs hundreds of lights in its illumination.

W. H. B.

St. Louis, October 2.

OUR CHICAGO LETTER.

Mr. W. H. McKinlock, president of the Central Electric Company, is at present out of the city on an extended business trip.

Mr. W. W. Low, special representative of the Central Electric Company, is in the city at present. We presume he is resting up prior to making a start on one of his usual successful trips for this popular house.

Mr. Lafayette Cole, representing the firm of Holmes, Booth & Haydens, passed through the city this week, en route for New York. Mr. Cole is returning from an extended Western trip; he reports an excellent trade.

Mr. Thomas Alva Edison paid Chicago a flying visit this week. He was on his way West. He will spend a day or two in Chicago on his return trip, and will take into consideration important company matters pertaining to their World's Fair electrical exhibit.

Mr. Geo. C. Pyle, of the National Electric Headlight Company, of Indianapolis, was a recent Chicago visitor. The special vestibule limited trains of the Chicago and Eastern Illinois Railway have been equipped with this excellent system of locomotive electric headlights.

The Sperry Electric Mining Machine Company have, after a great deal of experimenting and expenditure of money and time, perfected an entirely new fuse wire. They are now manufacturing and have in stock at all times a complete line. These fuses can be relied on for correctness of carrying capacity and uniformity of size. They issue a complete price list and explanatory catalogue. The factory is now at Thirty-ninth and Stewart avenue, this city.

Three thousand two hundred cars in five and one-half days.—This is the record of the number of cars actually hauled a distance of 6,000 feet by one of the new Sperry Mining Motors. Averaging one ton to the car, this means 3,200 tons of coal hauled in the above time. This work was done in No. 3 shaft at the mines in Streator, Ill. The motor was also idle nearly one-half of the time, waiting for loaded cars and empties. Another entry is being wired, so that the motor will be able to haul from 800 to 1,000 cars every day.

The Waterloo, Ill., Electric Light and Power Company are making good progress with the installation of their plant, and expect to be ready for operation by November 1. The work is in the hands of the Interstate Complete Electric Construction Company, of St. Louis, and the steam plant will be furnished and erected by the Pond Engineering Company, of the same city. The latter contract covers Armington & Sims engine, steel boiler, Lowe heater, Blake boiler feed pump and Universal injector. The Heisler system of long distance incandescent lighting is to be used, and the plant is to be a model one in every respect.

One of the new adjustable sanitary cars, invented and patented by Mr. J. B. Low, of San Francisco, has been running on the cable line of the North Chicago City Railway for some weeks, and we understand the company have purchased 50 of the cars to be put in service as fast as completed. It will be remembered that the cable system was first made a success in San Francisco, and now it remains for a San Franciscoan to come forward with another revelation in the manufacture of street cars. This patent combination can be changed from an open or summer car to a closed or winter car, or *vice versa*, in about two minutes. For electric roads, in particular, this would do away with about one-half the equipment, as one motor and the same car would do for all seasons of the year. The Low Adjustable Car Company, of Illinois, has been formed, and will commence the manufacture of these cars at once.

L. W. C.

Chicago, October 3, 1891.

OUR ALBANY LETTER.

The Deposit Electric Company is the name of the new corporation which will furnish Deposit, N. Y., with electric lights.

The Lundy Hill, N. Y., Electric Light Company is considering the matter of moving its station to the river and using water as a motive power.

The board of village trustees of Mount Vernon has granted a franchise to the Westchester County Railroad Company to run electric cars by the trolley system through the streets of that village. This road is to run between Yonkers, Mount Vernon and New Rochelle, in the vicinity of Starin's Glen Island.

The huge gun shop at the Watervliet Arsenal is now lighted by electricity. The contract for establishing the plant was awarded to the Edison Electric Light Company, of New York, and the work was commenced last Spring under Superintendent Driver. There are about 400 incandescent lights in the building and three arc lights. The shop is lighted from 4.30 to 6 o'clock each evening. The officers are highly pleased with the new plant.

Albany, October 3. L. M. W.

Telephonic News

*** The Little Rock, Ark., telephone exchange operates 608 instruments and 450 miles of wire.

*** The central telephone station has received not a small amount of Chinee patronage for the past few days. Manager F. W. Quinn was not a little puzzled to "sabbe" the Chinee lingo, at first, but being apt and quick to catch on, has, by close attention, managed to acquire the language, and can now speak it so easily and rapidly that he makes the almond-eyed tribe ashamed of themselves.—*Bingham, Utah, Bulletin.*

Erie Telephone.

President Sprague and Treasurer Glidden, of the Erie Telephone Company, together with Directors Russell and Pickering, have returned from the annual meetings of the Cleveland and Northwestern companies and a general inspection of the properties in Minneapolis, St. Paul and Cleveland. They are unanimous in report as to the favorable condition of the Erie property and the prospects for the continued large increase of subscribers.

President Sprague says: "The telephone business is still in its infancy. We have nearly completed our entire underground work, which has been under way the past three years, and when finished this Fall we will have underground facilities in every direction from our central offices in the three cities, to points varying in distance from three-quarters of a mile to a mile and one-quarter. For the future increase of business that comes to the company, all that will be necessary to do will be to draw in the cables and connect them up.

"The poles taken down in this territory are re-dressed and used on the outskirts and sent to the smaller exchanges, as are also the wires. Our excavations at St. Paul, for a mile in two directions from the central office, were made through a peculiar composition of sand and clay, enabling us to construct a tunnel, without the use of brick or stone, of a size large enough for us to walk through, the cables hanging on pins on the side of the tunnel. At other points we lay a conduit, into which the cables are drawn.

"For our Fall and Spring increase of subscribers, and to fill the extensions underground this year, we have orders with the manufacturers for over 1,000 miles of conductors in cables. Our new multiple switchboards placed at Minneapolis, St. Paul and Cleveland, are giving excellent service. With this apparatus we are enabled, with a reduced force, to give a much better service. I think our increase of subscribers will average about the same as last year, namely, 1,000. We have now connected over 13,500 subscribers."—*Boston News Bureau.*

Telephone Legislation.

One Michigan statute relative to telephone companies provides, says *Bradstreet's*, that the stockholders of all corporations organized under this act shall be individually liable for all labor performed and materials furnished the corporation, which liability may be enforced at any time after an execution shall be returned not satisfied against the company. Another statute provides that no proceeding shall be taken to enforce the individual liability of a stockholder until after an execution issued on a judgment against the corporation to the county in which its principal office is situated has been returned unsatisfied, in whole or in part. The Supreme Court of Michigan held, in the case of Ripley *vs.* Evans, reported in the *Railway and Corporation Law Journal*, that, in order to enforce the liability of stockholders in telephone companies it is not necessary that an execution shall be issued in any other county than that where the principal office of the corporation is situated; and evidence that the corporation had property in other counties, which might have been levied upon, was properly excluded as immaterial. The Court further held, in the same case, that the fact that a law entitled, "An Act for the organizing of telephone and messenger service companies," fixes the liability of stockholders in such companies for certain debts thereof, does not render the act repugnant to Const. Mich., Art. 4, S. 20, which provides that "no law shall embrace more than one object, which shall be expressed in its title," and that the law prescribing the manner of enforcing the liability of stockholders for debts of a corporation is not rendered class legislation by section 1, which makes it inapplicable to suits for labor brought by the laborer.

The Nassau Door-Bell Outfit.

The Nassau Electrical Company, New York, have just brought out the very compact electric door-bell outfit shown in the accompanying illustration. The outfit consists of a hardwood frame to which is affixed an iron box electric bell, of best construction, and a Nassau capsule battery, held by contact springs, and protected by a movable guard, besides wire, staples, etc., ready for setting up. It is one of the smallest and neatest door-bell outfits that has yet been produced.

NASSAU DOOR-BELL OUTFIT.

Queen's New Portable Galvanometers.

To meet recent demands, Messrs. Queen & Company, Philadelphia, have brought out several new types of galvanometers. The instrument shown in the cut is one of them. The galvanometer itself is an astatic one, fibre suspended, of which the needle is automatically lowered and its weight taken from the fibre by a simple closing of the lid. The galvanometer is set in such a way that it can be rotated about its vertical axis so as to bring the plane of the coils in the plane of the magnetic meridian. The control magnet, seen in the cut, is adjustable in the length of its supporting tube, and can also be rotated about it. If it is not desired to use the magnet, it can easily be removed, being held only by two spring clips to the galvanometer proper, and held in the fittings placed in the lid for that purpose. In the bottom of the containing box are placed six chloride of silver cells, connecting with a series of small blocks on the right; a plug allows these blocks to be connected so as to use one or any number of these cells in series. By means of a small switch, seen at the left and back, the galvanometer and batteries can be thrown into the same circuit, or, by changing the position of the switch, into different circuits. In the latter case we have a galvanometer and battery which can be used in the ordinary way for ordinary Wheatstone's bridge work, while in the former arrangement, by applying two of the four terminals seen to a circuit, an immediate deflection of the needle will be the result of a complete circuit.

QUEEN & COMPANY'S PORTABLE GALVANOMETER.

This galvanometer is also furnished mounted, exactly as shown, but without the switch and battery cells, and hence becomes simply a portable galvanometer for use in the orthodox way.

The special D'Arsonval galvanometer, described as a part of Queen's latest model of their portable testing and resistance sets, is also mounted in the form as above described, both with and without the batteries. The case is of polished mahogany, with leather handle, and can be easily carried about.

Electricity on Shipboard.

BY LIEUT. HAMILTON HUTCHINS, U. S. N.

The Office of Naval Intelligence, at Washington, has just issued its tenth annual publication. Lieutenant Hutchins contributes an interesting article of which the following is a portion: Generally speaking, the past year has been marked by development in marine applications of electricity as follows: (1) A tendency to introduce accumulators and discard primary batteries; (2) an increasing demand for electric motor power, principally for training and elevating heavy guns and for controlling the fire of machine guns; (3) improvement of dynamos as regards external field and its effect on the compass; (4) increased power of searchlights and improvement of the apparatus for manipulating them; (5) improvement of governing power of high speed engines; (6) electric firing for rapid fire guns; (7) systems for night signals; (8) increasing demand for the telephone and its tendency to replace other means of communication. In addition to these it must not be supposed that the lamps, motors, and other electrical appliances now used on board ship, or even dynamos, have reached a state of perfection, or that the requirements have been fully met. He will confer a great benefit upon mankind who will build a dynamo that has little or no external field, and at the same time light, compact, efficient, and strong. The marine compound dynamo should be self-regulating, not only in preserving the potential constant, but also in preserving small variation of lead of the brushes with variable load. Other points can be cited if necessary to show that there is still room for improvement. No one questions the fact that we have some good electrical appliances on board the new ships, and we are indebted to a few of the leading domestic electrical firms for at once meeting the requirements in a fairly satisfactory manner with apparatus of American manufacture. But the conditions and requirements are continually subject to modification. We must keep pace with the times or else acknowledge that we do not possess the best, which we surely will not be content to do, for the unwritten policy of our government is undoubtedly to have not only the best ships as regards construction but also as regards equipment. Our ships are considered the equal of any of their type as regards construction; our guns are equal if not superior to those abroad, and we will not be satisfied if we do not excel ships of other navies in the equipment.

The call for dynamos, motors, etc., for naval use is small compared to the commercial demand, and as our merchant marine comprises but few steamers of any size doing passenger traffic, it is but natural that our manufacturers should devote little attention to marine apparatus; and in order then that there may be no delay in supplying the electrical outfit of a ship, especially in time of war, we must offer the manufacturers sufficient inducement if we are to expect them to compete with foreign makers, or even comply with the specifications. For instance, a contractor goes to the expense of designing a new type of dynamo, and if it fulfills the requirements he should be able to count on an order for a considerable number of them—in other words, sufficient inducement to enable him to keep a constant force, though small, employed on government work.

On the other hand, a contract once made, the contractors should be required to comply strictly with the specifications, or else they must expect the apparatus to be rejected; or, at the most, accepted under a penalty. To be sure, the government might manufacture its own apparatus, but with the present size of our navy this would not be advisable, nor is it the custom elsewhere. We must then create a demand for marine plants to enable us to have a sufficient number of firms ready to supply them. This demand would be brought about of itself with a development of our merchant marine, and this is probably the easiest solution of the problem. The past year has shown notable improvement in the way of increased competition for supplying marine installations, and with the advent of a merchant marine on the high seas we could be ready for any emergency that might arise requiring the supply of a large amount of electrical material.

PERSONAL.

Mr. Charles Ffrench, London correspondent of the ELECTRICAL REVIEW, was married September 9 to Miss Florence Elizabeth Burt. The ELECTRICAL REVIEW extends its most cordial congratulations and best wishes.

Mr. H. B. Prindle, formerly with the Thomson-Houston Electric Company, has begun business for himself under the name of H. B. Prindle & Company, in the Exchange building, State street, Boston. The new company will handle advertising, and has a special department for the preparation of catalogues and price lists.

Messrs. W. W. Nicholls, of Chicago, superintendent of telegraphs for the C., B. & Q. R. R., and Wm. S. Ford, of Denver, superintendent of the Colorado Telephone Company, were recent visitors at the Electric Club as the guests of Mr. J. J. Carty. The gentlemen from the West are spending several weeks in the East inspecting the telegraph and telephone systems of all the large cities.

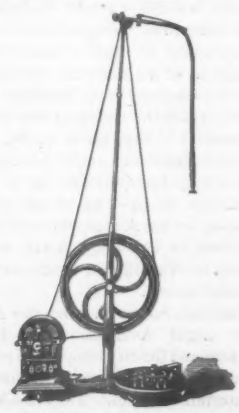
Edison Electric Dental Drill.

The accompanying illustration shows an application of a one-twelfth horse-power Edison motor to a dentist's drill.

The foot lever and crank are moved and the old pivot is utilized to fix a strip of steel upon which can slide the one-twelfth horse-power Edison motor, arrangement being made to clamp it in any position, so that the belt which is placed around the fly-wheel and pulley of the motor can be kept at any desired tension. The motor, therefore, occupies one of the legs, and the other two legs are used to support the reversing and resistance switch. The handle of the switch is of a special construction, so that the operator can use it as readily as the treadle. It is arranged to project over the edge of the resistance coil, and the operator can, by a slight movement of his foot, switch it over to either side, so that the motor runs in either direction at will.

If the arm is in the central position, the current is "off," if between the central position and one side, the motor runs in one direction, but not at full speed.

Catch clips are arranged so that the operator can tell immediately he has reached either the "off" position or the "full on" position on either side. He can also obtain four different speeds below full speed. The motor is designed to run on 125 volt circuit, so that it can be used on a local electric light circuit. A wall socket is fixed near the dental chair and a flexible cord led from this to two terminals on the motor.



EDISON ELECTRIC DENTAL DRILL.

Motors wound to be operated by a battery have been perfected, so that this ingenious device is placed within the reach of the entire dental profession.

The Lauffen-Frankfort Power Transmission.

GISBERT KAPP, IN THE LONDON "ELECTRICIAN."

The distance between the generating station at Lauffen and the receiving stations in the Frankfort Electrical Exhibition is 175 kilometres, or about 110 miles. Power was transmitted over this distance for the first time on August 25, when the current was supplied to about 900 sixteen candle-power lamps in the Exhibition, and a few days later the output was increased to 1,100 lamps. There are in the Exhibition two receiving stations, side by side, one for the production of power and the other for the production of light, both being connected in such a way that either power or light, or both together, may be obtained at will. The generator at Lauffen is a Brown "three-phaser," made and supplied by the Oerlikon Works, and the line consists of three hard-drawn copper wires of 160 mils. diameter, supported on oil insulators fixed to wooden poles 26 feet high. There have been erected in all about 3,000 poles, at an average distance of 200 feet, and the total weight of copper in the line is 60 tons. At Lauffen there are three transformers. One of these has been made by the Oerlikon Works and the two others by the Berlin Electricity Works. At Frankfort there are also three transformers, two made by the Berlin and one by the Oerlikon Works. The transforming ratio of all the six transformers is $\frac{1}{100}$ and they are oil insulated. In the power station at Frankfort, which was fitted up by the Berlin Works, the current is used for working a 100 horse-power three-phase motor, designed by Herr von Dolivo Dobrowolsky. The motor is coupled direct to a centrifugal pump, which supplies water to an artificial cascade 30 feet high. The lighting station at Frankfort has been fitted up by the Oerlikon Works, and the lamps are arranged partly on a large signboard of ornamental design in the Exhibition grounds and partly on lamp-boards in the Exhibition building, which serve for varying the load within certain limits.

The generator is separately excited, and a rheostat is provided, so that the attendant can compensate the loss of pressure in the line by adjusting the excitation. The common junction of the three armature windings is connected to earth, and the excitation of the field is so adjusted as to obtain from 45 to 60 volts between each branch and earth, according to the amount of power flowing out of the station. The common junction of the low pressure primary circuits in the transformers is solidly connected to the common junction of the armature windings and, by means of a fuse, to the common junction between the secondary or high-pressure coils of the transformers. The object of this connection will be explained presently. According to the voltage of the three-phaser, the pressure between any line wire and earth is, therefore, from 7,200 to 9,600 volts, and the pressure between any two line wires from 12,000 to 16,600 volts, being $2 \times \sin 60$ degrees of that in each branch.

The general arrangement of the circuits from the generating station at Lauffen up to the branches which lead to the power and lighting stations in the exhibition may best be described by means of the annexed sketch, Fig. 1.

In this sketch G represents the generator or "three-phaser," the three sets of coils being diagrammatically indicated by the three thick lines O I, O II, and O III, forming angles of 120 degrees with each other. The primary or low pressure coils of the transformer, T, are similarly represented by thick lines, and the three thin dotted lines o 1, o 2, o 3 represent the high pressure or secondary coils of the transformer. The generator coil O I is connected with the transformer coil O I, first by the earthed wire O O, as already mentioned, and also by an insulated circuit which contains an alternate current ampere meter A_1, a relay magnet R_1 and a fuse F. The other two set of coils on the three-phaser and transformer, respectively, are similarly connected. The voltage in the three branches is indicated by the three voltmeters V_1, V_2, V_3. The relay magnets are arranged for minimum and maximum current, and if the current in any of the three branches of the three-phaser should fall short of the minimum, or pass beyond the maximum value for which the relays are set, the relay in that branch cuts off the exciting current from the field of the three-phaser. The voltage obtained then in the low pressure circuit at the generating station is simply that due to the residual magnetism in the three-phaser, and, therefore, perfectly safe, even in case of a short circuit in the primary wires. As soon as the exciting power and with it the load is taken off, the turbine begins to race, and this is, of course, immediately noticed by the man in charge at Lauffen, who may then use his discretion whether he will shut down or not.

The fuses, relays, ampere meters and voltmeters belonging to the low pressure or primary circuit at Lauffen are mounted upon one board, which also contains the

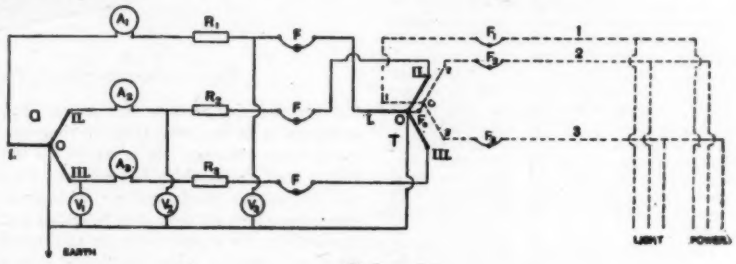


Fig. 1.

voltmeter and ampere meter for the exciting circuit, and the rheostats for the latter, by which the voltage of the three phaser is adjusted. In order to compensate for the ohmic resistance of the line, the attendant works by a table giving the primary voltage corresponding to various currents, so as to keep the pressure at Frankfort constant at varying loads.

It will be seen that the arrangements of switchboard and instruments at the generating station are of the simplest possible character. In the high pressure or secondary circuit there are no switches, but merely three fuses, F_1 F_2 F_3, as shown in the diagram. To make a fuse for 10,000 volts is not an easy problem, but it has been solved by Ferranti and others, and any of the existing forms of fuses might have been accepted for Lauffen. Since it is, however, the intention of the two firms who have carried out this transmission plant to work later on at double the present pressure (by using two transformers at each end with their thick wire coils in parallel and their thin wire coils in series), it was thought safest to arrange the fuses in such a way that there can be absolutely no doubt as to their satisfactory working, even at 20,000 or 30,000 volts. The method of mounting

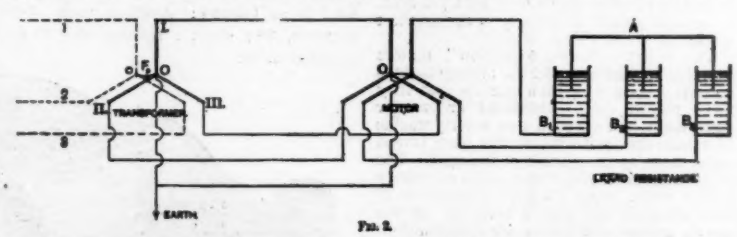


Fig. 2.

fuses on a board inside the station has, therefore, been abandoned, and the fuses have been placed outside, where they form part of the line. Close to the generating station there is a short piece of line in which each of these circuits consists of a pair of copper wires of only six mils. diameter, and about eight feet in length. There are two posts placed that distance apart to which the line wires are shackled, and the fuse wires serve to bridge the space between the posts. To facilitate the renewal of the fuses the posts are provided with steps. This provision is necessary, because the line is at Frankfort frequently short-circuited on purpose to advise the man in charge at Lauffen that he may shut down. For this purpose there is suspended over the three line wires at the Exhibition an angular stirrup or bridge of iron, which can be lowered by a cord so as to make metallic contact between the three wires. The fuses at Lauffen are thereby melted, and the man in charge stops the machinery. Telephones are then switched on at both ends, and the line wires are used to speak between the two termini. As long as the stirrup is on the wires in the Exhibition, it is perfectly safe to use the telephone, even if by some mistake the machinery at Lauffen were started whilst a person is on the telephone. The only effect in this case would be to immediately melt the fuses again, and as their replacement gives some additional trouble to the man in charge, he will in his own interest take care not to start the machinery before the appointed time.

It remains yet to describe the provision made to guard against accidental injury to life or property in case one of the line wires should break and fall to the ground, or an earth should occur on the line through some other cause. As will be seen from the sketch the common junction O of the thick wire coils of the transformer at Lauffen is joined by means of a fuse F_0 with the common junction O of the thin wire coils. The electrical center of the whole system is, therefore, permanently connected to earth. Suppose, now, that the line wire 1 should break at any point between Lauffen and Frankfort and fall to the ground, the broken end will make earth, and the corresponding fuse F_1 in the line at Lauffen will go. Possibly the junction fuse F_0 will go. The line 1 is thus cut out. In all probability the fuse in the low pressure circuit I will also melt; but should this not be the case, the current in this branch will be very much reduced, and set the relay R_1 in action, whereby, as already explained, the excitation is cut off, and the dangerous pressure is immediately taken off all the three line wires.

We have yet to describe the general arrangement of the circuits in the power station at Frankfort (Fig. 2). The primary and secondary of the transformers (of which only one is shown, the other being a spare transformer at present) are again earthed at their electrical center, and the same remark holds good for the field and armature of the motor. The latter is shown diagrammatically in the same way as if it were a transformer, though this representation is not quite correct. The armature and field coils do, of course, not remain in the same relative positions to each other, but for the sake of simplicity the diagram may be accepted as sufficient for our purpose. In reality, the field revolves with a greater speed than the armature, the difference in speed or magnetic slip producing the electromotive force in the armature. Now, the torque of the motor is proportional to the strength of the field and to the armature current, which latter increases with the electromotive force, and, therefore, with the magnetic slip. If the magnetic slip were zero, that is, if the armature revolved with the same speed as the field, there would be no electromotive force in the armature coils, and, therefore, no current and no torque. A motor of this class cannot, therefore, run synchronously, but must run the slower the more the load is increased. The variation in speed between full load and no load can, however, be made as small as desired by the simple expedient of using an armature of low resistance, so that even a slip of five per cent. or 10 per cent. shall produce the maximum current required at maximum load. In this respect the three-phase motor is identical with an ordinary continuous current motor with constant field, since also in this case the speed of the armature decreases as the load increases. To obtain more or less uniformity of speed is, therefore, simply a question of the amount of iron and copper which the designer chooses to employ for a given output; but it should be remarked that by increasing the section of the armature conductors so as to get very little magnetic slip, there is danger of producing a machine which will not readily start at full load. The reason is obvious. A very low armature resistance means an enormous armature current at the moment of starting when the magnetic slip is 100 per cent. Now, this enormous armature current reacts very strongly on the revolving field, which is, so to speak, blown aside by the ampere turns in the armature. This may, at first sight, seem a very serious drawback to the three-phase motor, but Herr von Dobrowolsky has hit upon a very simple and ingenious remedy. Instead of short circuiting the armature coils at starting, he inserts into each of the three branches a liquid resistance, consisting of an iron vessel filled with an alkaline solution, into which an iron plate can be dipped to a greater or lesser depth. The three vessels, B_1, B_2, B_3, are insulated from each other, but the three iron plates are joined by a metallic bridge, A. At starting the plates are immersed only slightly and the resistance which is thereby interposed in each of the three armature circuits prevents the creation of abnormally strong armature currents, which would otherwise blow the field aside. As the motor gathers speed the plates are more and more lowered until the whole of the liquid resistance is short circuited, and the motor works without external waste of energy. As regards the question of efficiency, no definite data are as yet available, since the commission have not yet begun to make their measurements. If we may judge from the absence of heating, vibration, noise, and the general smoothness of the running of this motor, there is every reason to hope that the efficiency will be as high as with a direct current motor of the same size. A rough test, which the writer was permitted to make on a three-phase motor of two horse-power, gave an efficiency of 82 per cent.

TELEGRAPHIC

.... Crews of men are working both ways putting up poles for the Postal Telegraph Company, between Rock Island and Peoria, Ill.

.... A model office will be that of the United Press Association, in the new Chicago *Herald* building, which is fast nearing completion. The Central Electric Company, of Chicago, have secured the contract for equipping this office, and have now on exhibition two large show cases full of the most modern types of telegraph instruments manufactured by J. H. Bunnell & Company, New York.

.... At 11 o'clock one night last week, Policeman McCarthy, in Dey street, New York, saw a man sitting on the crossbar of a telegraph pole, and two others waiting nearby. Thinking it was a queer time for a lineman to be repairing the wires, he started for the pole. The two men on the ground disappeared, but before the one on the crossbar could slide to the ground, the policeman was on the spot. At the foot of the pole was about $100 worth of copper wire. Before Justice Divver, at the Tombs, William Carroll, who was caught on the pole, pleaded guilty to cutting the wire from the poles and was committed.

The Chinese Don't Like the Telegraph.

An Associated Press despatch sent out from San Francisco, September 13, is as follows:

The steamer from China reports that over 20,000 people assembled at Lung Chow in the province of Hunan, recently, to prevent workmen from putting up telegraph lines. Ten thousand poles were burned and the men were driven over the boundary. A society has been formed to keep the telegraph out, and a mob is still on the watch. Great apprehension is felt by the inhabitants of the border districts in Hupei. At New Chang, Dr. Greig, a missionary doctor, has been assassinated by soldiers. The matter has been placed in the hands of Mr. Ayrton, British Consul. It is thought this is a local affair, not connected with secret societies.

Hunan is in central China. The name means South of the Lake, the province lying South of Lake Tung-Ting. It is also a little South of the Yangtse-Kiang, and it is the most fertile and best watered province of all China. With the province north of it it forms an immense basin, of which the greatest depression is occupied by the big lake. Its population is over 18,000,000. Its people have been very little influenced in any way by the Western world, and are greatly opposed to innovations. The London *Times* a few weeks ago called Hunan the most troublesome province in the empire.

* * The electric railroad at Oswego, N.Y., has begun operations.

* * It is said that the Broadway cable road will be opened May 1, 1892.

* * The Jamestown, N. Y., railway will inaugurate a local freight service.

* * The electric railway at Jackson, Mich., was opened September 19, at 3.20 P. M.

* * The Allegemeine Elektricitats Gesellschaft, of Berlin, is preparing to install several electric railways in Russia.

* * The Bay City, Mich., Electric Railway Company will erect a large hotel at Wenona Beach, the out-of-town resort of the Bay Cities.

* * The city of Lincoln, Ill., will have an electric street railway, three motor cars and three trailers, within 60 days, put in by the Edison General Electric Company.

* * The electric railway company at Windsor, Ont., imported steel rails for their road, and the Custom House has decided that they owe $2,500 duties. The matter will be disputed.

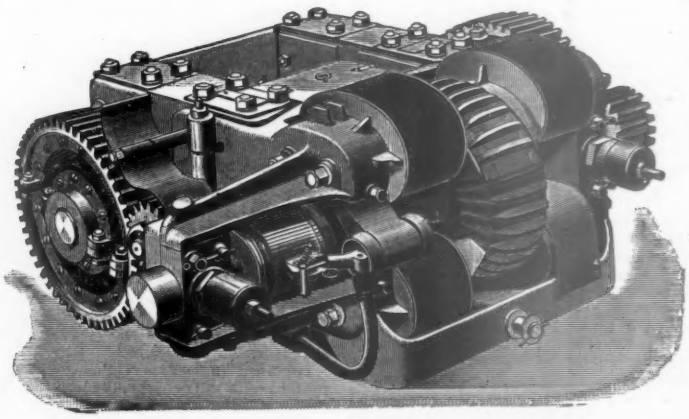


FIG. 2.—STANDARD SHORT ELECTRIC RAILWAY MOTOR.

* * It has been suggested that the electric railway between Salt Lake City, Utah, and Fort Douglas inaugurate a baggage and freight service, as business between these points seems to demand it.

* * The town clerk of Port Arthur, Ont., advertises for bids on $75,000 of debentures issued for electric street railway purposes. The debentures are issued in amounts of $1,000 each for a period of 30 years, bearing interest at the rate of four per cent. per annum, payable half-yearly.

* * A despatch from New Haven, Conn., says that Walter, Cook & Wagner, of Wall street, New York, have purchased two of the street railway systems of that city—the West Haven Horse Railway Company and the Winchester Avenue Company. The purchase is in the interest of a syndicate of Eastern capitalists which recently purchased the street railways of Detroit, Mich., for $7,000,000. The New Haven roads purchased are profitable concerns, and will be immediately equipped with electricity.

Tests of the Short "Gearless" Motor.

During the past month the "Gearless" motor has been very thoroughly tested in Cleveland, being put to the hardest kind of work, in regular commercial operation. Among some of the noteworthy tests may be mentioned the following:

In order to prove the power of the motor, it was attached to two other motor cars and drew them without difficulty along a rough and dirty track, attaining a very fair rate of speed. The car was stopped at the commencement of a 40 foot curve, at the other end of which was a three per cent. grade. It was then started up, and without difficulty drew the three cars around the curve and up the grade. This was one of the severest tests which could be put upon the motor under all the conditions. A prominent electric railway manager, who was present, stated that not a single motor on his line could do the same work.

The car was put into service on three of the Cleveland street railway lines, carrying trail cars and drawing heavy loads without the slightest difficulty, and at speeds far in advance of the ordinary schedule of the road. Current and voltmeter readings were taken in each case, showing that the power consumed was even less than had been anticipated by the Short people themselves.

In one of the tests the trail car ran off the track at a curve. Its brakes were set and it was drawn onto and around the curve with the full load of passengers on both cars and without the slightest difficulty.

The Short Electric Railway Company has equipped a car with its "Gearless" motors, to go into operation for short periods on a number of the most prominent lines in the country, in order to thoroughly familiarize the street railway public with the advantages to be obtained from the use of a "Gearless" motor. The car will first be sent to Albany, N. Y., where it will be put into regular service on the State street grade, which is one of the longest and most severe grades in the East, averaging about eight per cent. for a distance of one-half mile, and five or six per cent. for a much longer distance. The car will probably be sent next to the South or West.

The Jamestown Street Railway Company is operating one of the most successful electric street railways in the country, although the conditions under which the electric equipment is obliged to work are of the severest character. The road is a succession of grades running up to over nine per cent. in several places, and many of the heaviest grades have also sharp curves.

The Short "double reduction" motors are used exclusively, and the management is so well pleased with their success that they have placed three additional orders for equipment, and are even now utterly unable to handle the traffic which has been forced upon them by the success of the road. The Short motors are called upon to do extremely heavy work, being obliged to propel an 18 foot vestibule car with a trail car up the heavy grades and under all conditions of track and traffic. The Short dynamos are proving their superiority, and are frequently called upon to develop much more than their rated capacity.

The Lakewood line, recently opened, has also been heavily patronized. Visitors to Jamestown go away deeply impressed with the service of which electricity is capable in street railway work.

The Short motors have been in operation on the Georgetown and Tennallytown road for some two months with excellent results. They are carrying heavy loads at high speed and the cars are very popular. This road will be the first in the South to be equipped with "Gearless" motors, an order having been placed by Mr. R. H. Goldsborough several months ago.

The Short Electric Road at Rockford, Ill., is meeting with excellent success and is about to extend its lines. The service is very popular, and the management is given credit by the citizens for installing one of the most perfect electric street railways in the country.

The Houston Street Railway Company has placed an order with the Short Electric Railway Company for "Gearless" motors, to be used upon its lines. This will be the first road in the Southwest to prove the merits of the "Gearless."

The Short "Gearless" Motor.

The Short "Gearless" motor is illustrated in the accompanying engraving, Fig. 1.

The number of bearings is reduced to two on each motor, making four in a car equipment. The armature speed has been reduced to the minimum, viz., that of the car axles in practical operation. The noise of gearing and the "squealing" of commutator brushes are entirely obviated, and there are but three wearing parts on each motor. The armature is of the ring type, of comparatively large diameter. It is keyed to the hollow steel shaft, which is concentric with the axle of the truck, and an inside clearance of one inch all around is provided for. The coils of the armature are, in this, as in all Short machines, entirely independent and perfectly ventilated. The motor has eight field magnets, four on each side of the armature. They are bolted to the frame-work of the motor, in the center of which are the bearings which carry the hollow armature shaft. Mounted upon the hollow shaft, close to the armature, is the commutator, which is protected from injury by the surrounding pole-pieces. A three-armed spider is placed upon each end of the hollow shaft. Each arm is provided at the extremity with a socket to receive a rubber cushion or spring. These cushions bear upon lugs cast on the car wheels, and as the armature shaft and spider revolve, the action is imparted to the car wheels. This rubber cushion serves the double purpose of insulation and easy starting.

From the center of the axle to the bottom of the casing is 12¾ inches. At a speed of 12 miles an hour the armature revolves at 94 revolutions per minute, with a 36 inch wheel. The electrical output of the motor obtained from thousands of readings taken on the three electric railway lines in Cleveland is as follows: Average volts, 480; amperes, 24; electric horse-power, 15.44; passengers, 48.

FIG. 1.—SHORT "GEARLESS" ELECTRIC RAILWAY MOTOR.

Fig. 2 shows the Short "double reduction" or geared motor, called the "Standard."

This and the "water-tight" are the only motors on the market having wooden web gearing, by means of which the perfect insulation of the motor from its frame and truck have been secured. The pinions are of solid steel, of large diameter and with large teeth. The rim of the wooden web gear is of cast steel. The motor frame in this, as in the other two forms of motor, is in one piece and is held by flexible supports. The "single reduction" or "water-tight" motor is shown in Fig. 3. One pinion and one gear have been dispensed with and arrangements made to run the remaining gear in oil. The machines are practically the same and a series of efficiency tests show that in economy of current and in output of power, there is little choice between them. The "water-tight" motor, however, is smaller than the "Standard" motor and, it is claimed, is the lightest and smallest street car motor thus far constructed. It weighs something less than 1,800 pounds. It is encased in and entirely protected by its iron frame and can be operated on 30 inch, 33 inch and 36 inch wheels, and on any gauge of track down to three feet. It is in great demand for narrow gauge roads and for mining and other electrical haulage purposes. It is made in two standard sizes, 15 and 20 horse-power.

Carefully kept records of the operation of electric cars on the many roads equipped with Short geared motors show that the cost per car mile ranges from two to four mills. One of the most valuable features of all Short machines is the facility with which they can be repaired in case of necessity. By loosening four bolts in the motor framework and taking off the iron strips below the wheel box, a car equipped with "gearless" motors may be jacked up and axle, wheels and armature complete, run out from under the car. The armature coils may be rewound without removing the armature from the car axle. Field coils can be repaired as easily. The commutator may be reached and dressed while the machine is running. With the geared motors it is not necessary to remove the motor and car wheels. A car can be run over a pit and every part of the motor reached without difficulty. The commutator, field coils and armature are easy of access, and the armature can be removed in case of necessity by two men in eight minutes, its weight being only 198 pounds.

FIG. 3.—SHORT SINGLE REDUCTION ELECTRIC RAILWAY MOTOR.

"Steam."

The twenty-fourth edition of "Steam," published by the Babcock & Wilcox Company, New York, is at hand, handsomer and more complete than ever. Among the most valuable additions to this issue are a lecture on the circulation of water and a most valuable table and formula on equation of pipes. The table on properties of steam has been made to conform to the latest investigations of Professor Peabody. Every steam user should possess a copy of this valuable work.

Direct Coupled Multipolar Generator.

BY WM. LEE CHURCH.

It is somewhat remarkable that, advanced as American engineers are in general mechanics, they should be so far behind European engineers in the matter of heavy construction in power stations. It is doubtful, however, if the responsibility really rests at the door of the engineering profession. The assignable cause is probably commercial. Large and relatively slow speed generators coupled to vertical compound engines of several hundred horse-power is the general European practice. But European capital, contenting itself with smaller and slower returns, is willing to make the disproportionate investment required by the comparatively slow speeds which are alone possible to the forms of construction there adopted. In this country we must have faster running machinery, more compact in form and of a greater earning capacity per dollar of cost. When we add to this the further imperative requirement of safety, economy of maintenance and operation, and economy of fuel under fluctuating loads, we have erected a problem which can be permanently and successfully solved only by compound or triple expansion engines of special designs, having in view a terminal pressure of exhaust which shall not fall below atmosphere, even under light loads. Such an engine would come under the high speed class, while the dynamo would in its class be distinctively low speed. The original idea, attempted in various shapes, of forcing an engine to an abnormal speed to meet the supposed necessities of the dynamo, was unnatural and wrong. The present state of electric art now permits the reasonable practice of cutting down the speed of the dynamo to the normal requirements of the engine.

In this direction all modern engineering is strongly tending, and there is no longer room for doubt that the generating plant of the future, so immediate as to be even now the present, is to be the direct coupled, slow-speed, multipolar generator for railway stations, and the same system in connection with a dynamo for electric lighting.

The advantages are sufficiently apparent. The first cost of a plant on this principle, as compared with a system involving counter-shafting, clutch pulleys, belt tighteners, belts, etc., would be enormously in its favor. This is obvious when referring to the machinery alone, but is strongly emphasized when the further value of the reduced cost of real estate and buildings is considered.

Every transformation or transmission of energy is a loss of money, and it follows that, when the crank shaft of the engine is the armature shaft of the dynamo, the loss is reduced to its lowest terms. Consider for a moment that the normal resistance of an armature is strictly torsional, and the difference will be quickly appreciated between the power required to drive it when spinning it by the end, against that required to drive it under the transverse strain of a heavy belt. Under ordinary conditions the belt strain to transmit 200 horse-power will be about 1,500 pounds, and the friction due to this strain is twice repeated; once on the shaft of the engine and once on the shatt of the dynamo. This is the simple case of an engine belting direct to the dynamo. Where counter-shafting is employed the frictional loss is again doubled by being repeated at the receiving and delivering bearings of the counter-shafting. The work required to overcome this friction is a net loss and can never fall below the minimum above described when everything is in line. If the engine shaft, or still worse, the counter-shaft, is out of line, the friction load may run up to any figure, limited only by the preservation of the bearings. With the direct connected dynamo the frictional load due to these causes entirely disappears, leaving nothing but the internal friction of the engine to be accounted for.

Next to the direct saving in power comes the saving in space. As a general statement, fully twice as much generating capacity, with the same accessibility and convenience, can be got into a given floor space with the coupled dynamo as with the direct belted generator, and from four to eight times as much as with indirect belting through counter-shafting. This tells immediately upon the cost of real estate and buildings, and the accompanying items of taxes, insurance and interest.

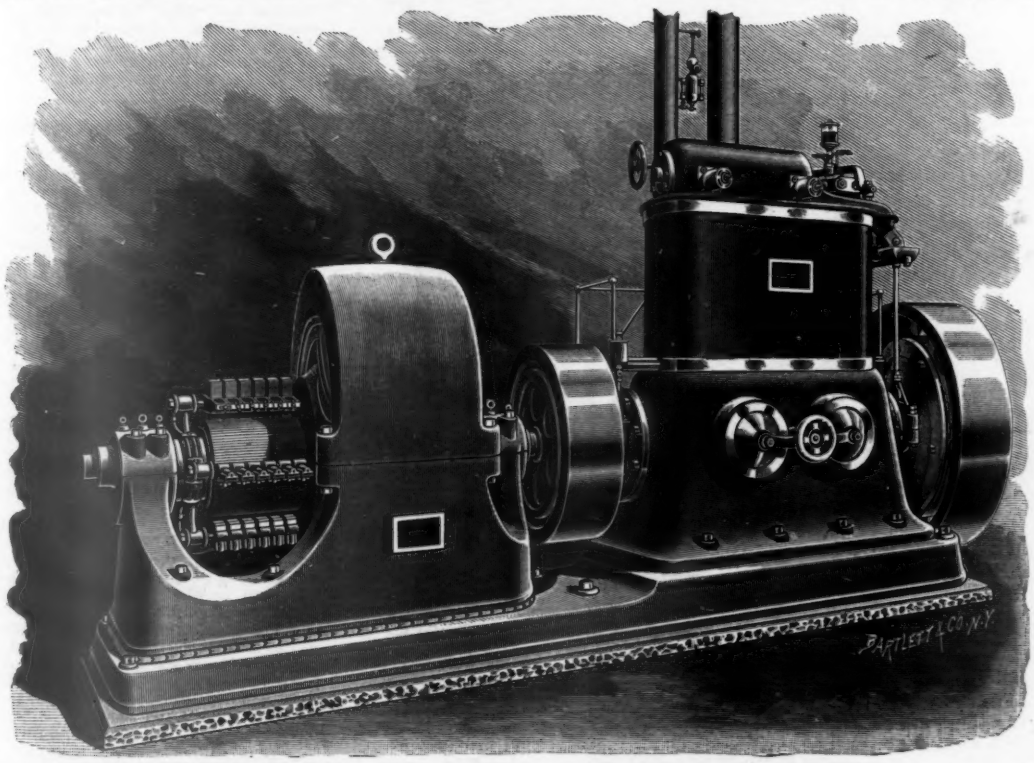
In the item of attendance and maintenance, the coupled generator possesses manifest advantages in eliminating the belt account wholly and the oil and babbitt account in large part.

Most operators will gladly welcome the absence of the noise which is inseparable from the use of belting. This becomes an important and oft-times a controlling condition in stations centrally located in business and residence districts. Not the least of the recommendations of the coupled generator is that it is strictly noiseless.

Recognizing the demand for this form of generator and the certainty of its permanent success, Messrs. Westinghouse, Church, Kerr & Company have, in connection with the Westinghouse Electric and Manufacturing Company, developed it in the form as indicated in the engraving, and are now placing it on the market as a thoroughly practical self-contained machine. The engraving represents a 250 horse-power generator for railway work, coupled to a compound engine capable of developing 250 horse-power on 100 pounds of steam, non-condensing, speed being 250 revolutions. The design is that of a single machine carried upon a massive bed-plate requiring only a moderate foundation. The generator is thoroughly insulated from the bed-plate by a sheeting of tarred plank, the bolts being insulated by bushings and washers of non-conducting material. The insulation is completed at the coupling, in which non-conducting material is interposed to prevent the possibility of metallic contact. The electrician will recognize the value of this protection. The coupling is further so designed that it will yield fully to any misalignment of the two shafts, either as to angle or position of centers. The larger engines are provided with unhooking gear in the valve motion, so that they can be handled by a starting-bar, and are also fitted with a gallery sole-plate and stairway protected by hand rails, so that the throttle valve and lubricator are conveniently accessible.

The same general design is carried out for direct coupling to heavy alternating dynamos. The sizes at present manufactured correspond to 125, 250 and 500 horse-power, with 1,000 horse-power to follow. The sizes of engines required for the given power will vary according to the steam pressure carried; 180 pounds being contemplated as a maximum and 100 pounds as a minimum.

The same concern has also completed the preliminary work of a design for a third high pressure cylinder for converting the compound engine into triple expansion.



DIRECT COUPLED WESTINGHOUSE SLOW SPEED MULTIPOLAR RAILWAY GENERATOR.

Electrical Heating.

Among the many interesting and instructive exhibits at the recent Montreal Convention, and one which attracted particular attention, was that of the Burton Electric Heater Company. Many street railway managers have been quick to see the advantages of this method of heating—such as economy of space, time and money—and its merits are well understood by them. The exhibition of the heaters in actual operation on an incandescent light circuit was the means of awakening an interest among the central station men and showing them their varied usefulness, which may be so turned as to enhance their own business interests.

We are glad to learn that there will be a complete exhibit of the heaters at the street railway convention in Pittsburgh, and also that Dr. W. Leigh Burton, the inventor, will be present, which circumstance will certainly add largely to the interest of the exhibit. This will be an occasion for street railway men to examine the heaters personally and to determine the comparative value and economy of electric and other heaters. Electrical heating, as electrical lighting, is of universal interest, and having received its first successful employment upon electric cars, must necessarily be of deep interest to all street railway men.

ELECTRIC LIGHT NEWS

—— The Chesapeake and Ohio Railroad is experimenting with electric headlights for its locomotives.

—— Edison General Electric Company has declared a quarterly dividend of two per cent., payable November 2. Books close October 12 and re-open November 3.

—— A semi-annual dividend of three per cent. has been declared by the Edison Illuminating Company, of New York, payable to stockholders of record September 23.

—— Mayor Rose, of Johnstown, Pa., has signed a contract with the electric light company for 146 arc street lights for that city, for five years, at $108 per year for each light.

—— At a special town meeting in Peabody, Mass., last week, it was voted by 225 to 10 to establish a municipal electric plant, and $47,000 was appropriated for that purpose. A circuit of 120 arc lights will be established at once, and incandescents as desired.

—— The Southern Gas Trust and Construction Company, controlling and operating the Palatka, Fla., Gas Light and Fuel Company, and the Gainesville Gas and Electric Light Company, has been placed in the hands of a receiver. Many of the stockholders reside in the North.

—— The Silver Bow Electric Light Company, Butte, Mont., will shortly enlarge its plant by the addition of much machinery. A generator of 86 horse-power, a 1,300 incandescent light dynamo, a 50 arc light machine and a 75 horse-power engine are to be added as soon as they can be secured. Two 100 horse-power boilers are also to be added.

—— Lord Stanley has promised to do all he can to have the Dominion of Canada make a creditable exhibit at the World's Fair. Many prominent Canadians are equally interested and have promised their aid. This result is due in a large measure to the exertions of J. Allen Hornsby, of the Department of Electricity of the Exposition, among the delegates to the recent National Electric Light Association at Montreal.

—— Muncie, Ind., will be lighted by electricity made from a plant owned by the city. After a hard fight by some of the members of council, the matter was settled last week by a unanimous vote that the ground be purchased and advertisement be at once made for bids to erect buildings according to plans and specifications already submitted. The plan of lighting has not been decided upon, but the plant will at once be put in at a cost of about $30,000.

—— The annual meeting of the stockholders of the Narragansett Electric Light and Power Company was held at the Pier recently. John Babcock, Thomas B. Robinson, William C. Clarke, B. F. Peach, Jr., and E. I. Garfield, were elected directors for the ensuing year. A full settlement for the damages to building, machinery and supplies has been effected with the insurance companies, and the repairs on the station are now being pushed with all possible speed.

GENERAL NOTES.

The Central Electric Company report that eight of the large buildings now being constructed in Chicago, to contain in the aggregate 14,200 incandescent lamps and 850 arc lamps, are being wired with Okonite wire.

The Interior Conduit and Insulation Company will be represented at the Street Railway Convention at Pittsburgh by Mr. Edward H. Johnson, president, and Mr. E. T. Greenfield, electrician. The company will show their improved method of burying the feeder wires of electric railway systems and their new junction box.

Recent Progress in the Use of Electric Motors.

ABSTRACT OF A PAPER READ BEFORE THE BRITISH ASSOCIATION BY PROF. G. FORBES.

In the application of electric motors I have noticed three directions in which this country needs the testimony of independent and impartial people to assert the value of applications which in some other countries are generally adopted. These are: (1) Electric railways. (2) Replacing shafting in shops by electric conductors and motors. (3) Transmitting power to a distance from waterfalls and rivers by electricity.

Electric Railways.—These are thoroughly established in America on the cheapest system, *i. e.*, electricity supplied from a central station by overhead wires. The extensive adoption of electric tram lines in America, and the small number in England, is certainly due to the fact that they allow these overhead conductors and we do not generally do so. The most trustworthy estimates seem to vary between 4.18 and 6 cents per car mile, including coal, attendance, land and buildings, machinery, line, oil, water and waste. The question of repairs is serious and must be reduced. Most of the lines adopt spur gearing to reduce the speed from the electric motors to the car axles. They generally use two pinions and two spur wheels. This introduces great friction. It is very generally accepted that eight horse-power is lost in gear friction, though this seems somewhat incredible, being about 30 per cent. These cars are large and the motors are of 30 horse-power. This enormous power is absolutely demanded to enable them to start on a gradient with facility, and they do this. There is no crawling about these cars. You feel that there is plenty of power for the work. The noise in these cars used to be very considerable, and the injury to watches through magnetization was at one time an objection. The noise from the gearing, especially when worn, has been deadened by enclosing the motor and gearing in cast iron boxes. The magnetization of watches is prevented by adopting a suitable type of motor. Another source of trouble in motors used to be the brushes, for sparking is liable to be very violent with the variable load of a tram motor, and the commutators wore away rapidly. Since carbon brushes have been introduced this difficulty has entirely disappeared.

The loss in double reducing gear and the wear and tear led to all the important companies turning to single reducing gear with rather heavier motors. It would at first appear impossible to go farther and adopt armatures on the wheel axles without sacrificing the great advantage of gearing, which allows the motors to be independently supported without being subjected to the same shocks as the wheel axles. In spite of this, the Westinghouse Company has introduced a gearless motor which has strength enough to stand the shocks. But other inventors had the idea of fixing the armature alone on the axle and supporting the field magnet wholly on springs; to support it partially on springs is of little value. In this direction the most important and promising plan seems to be that adopted by Eickemeyer and Field. They support the whole motor in guides on springs, and connect the motor axle and the wheel axle by cranks and a coupling bar, the cranks on the right and left sides being at right angles to each other. This seems to reduce gearing friction to the minimum, while completely obviating shocks.

In America spur gearing is almost universal, but in Switzerland the Oerlikon Company are introducing worm gearing, which has been so much approved by Mr. Reckenzaun. Storage batteries have not generally been successful in America, but in some trials have worked very well.

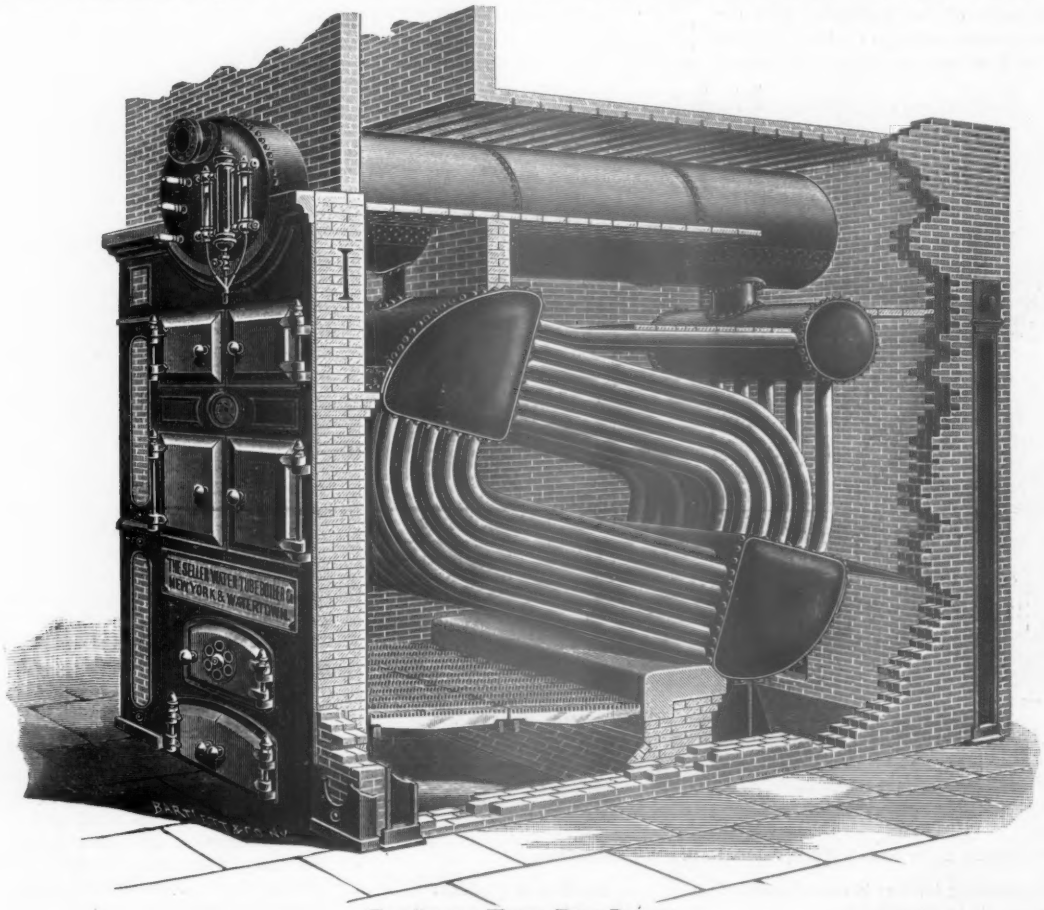
Replacing Shafting by Electricity.—The benefit of replacing shafting by electric conductors and motors has been thoroughly appreciated in America. Every one knows of the hundreds of motors for small work which are supplied with electricity by central stations in Boston and New York, besides other places, and of the large number of electric lifts supplied by the Otis Company with electric motors designed by Eickemeyer. I will only place before English manufacturers two of the establishments where a statement of what has been done is enough to bring conviction to the mind of every shrewd and sensible employer of power. In the great works of William Sellers & Company shafting has been abolished as far as possible. The second establishment is Baldwin's locomotive factory, whence from 16 to 20 locomotives are sent off every week, and where space is so valuable that there is no room for shunt lines, and where a 100-ton traveling crane picks up one out of the 20 and puts it down where wanted. This fine traveling crane, and every other crane in this huge part of the works, are driven by electric motors.

Transmission of Power to a Distance from Waterfalls.—With regard to transmission of power to a distance from waterfalls, I have seen little to chronicle in America, and what there is seems rather antiquated; but in Switzerland important work has been done both by continuous and alternating currents. The high tension electrical work, in connection with continuous currents, that most impressed me, was what has been done by Cuenod, Sautter et Cie. Their six-pole machines, with Gramme commutators up to 2,000 volts, designed by M. Thury, seem to work admirably and sparklessly, and I must here state my conviction, which I did not previously hold, that the insulation of such a machine can be made perfect, as there done, by supporting the dynamo or motor on a number of alternate slabs of vulcanized rubber and porcelain and by connecting the shafts by Raffard couplings.

I will not take up time with describing different works of this kind, but I will now say something about the use of multiphase alternate or rotary currents, about the prospective use of which so much has been published. I have seen the machines and transformers in course of construction at Oerlikon, and the insulators which have been used; the mechanical design is excellent. I can quite appreciate the difficulties of regulation of three currents referred to by M. Dobrowolski, but I think that there are further points upon which information is much wanted. I want to know, for hitherto I have utterly failed to see the advantage of this three-phase synchronising alternator over the simple alternators which do such excellent work. I have been told that calculation shows that Mr. Brown's machine has 96 per cent. efficiency as a dynamo. Well, I reply that an ordinary alternator without iron, not having the hysteresis of Mr. Brown's machine, ought to have a higher efficiency. In the next place I am told by Mr. Brown that while you cannot switch one of these three-phase synchronising motors, with its load, onto an electric circuit, and expect it to get up to the synchronising speed, yet it will do so along with the electric generator of electricity, if the latter be also started from rest. In this it certainly has the advantage over the synchronising alternator with iron, but none whatever over those without iron, which will act in precisely the same way, unless the motor happens to be stopped on dead centers, *i. e.*, with the centers of coils (in a Mordey alternator, for example) half-way between the poles of the field magnets. If this is the only gain over single phase alternators with self-induction, and if there be no advantage gained over alternators without large self-induction, I fail to see the merit of the complication of three phases. I would not have drawn attention to the absence of advantage, but would have preferred to await the experiments before expressing an opinion, were it not for the great attention directed to the scheme by the press, altogether out of proportion to the results which Mr. Brown and the Oerlikon managers hope to obtain. The great experiment about to be tried at Frankfort, which interests electricians all over the world, is not to prove that transformation is efficient, but to prove that 30,000 volts can be carried along 112 miles of overhead conductor.

M. Dobrowolski says that whatever load may be put on his motors there is no serious difference in phase between the potential difference applied to the motor and the current, and there is no appreciable lag. If this be so it would be a decided improvement, but I shall require strong proof before I accept the multiphase motor as a great advance over the Tesla machine. The only advantage which it possesses over synchronizing alternators without iron in the armatures and with large momentum lies in its power to start with the load on. But I do not see that in large applications this advantage is to be compared with what it loses by its want of synchronism. M. Dobrowolski claims that these machines have the further advantage over the synchronizers that they will not stop when overloaded. After having tested Mr. Mordey's synchronising alternators, I have a strong conviction, almost amounting to a feeling of certainty, that it is impossible to put them out of step in ordinary conditions by merely increasing the load. The more you increase the load the more current goes through them to keep them in step. They would rather get red hot than get out of step. They behave just as a continuous current motor or Tesla motor, or a Dobrowolski motor, behaves under the same conditions—it gets hot, but it does not stop.

People seem to be greatly at a loss to explain why it is that some alternators work well as motors while others do not. The explanation is simply that the former have a large momentum and the latter have not. I announced this explanation of the difficulty at a meeting of electricians in Paris last February, and found that M. Hospitalier had arrived at exactly the same conclusion, and quite independently. I feel confident in predicting that the Ferranti dynamo, if supplied with a heavy enough fly-wheel, will be found to work as well as the Mordey machine as a motor.



THE SELLER WATER TUBE BOILER.

Seller's Patent Water Tube Steam Boiler.

A new water tube boiler is shortly to appear on the market which will be a strong competitor of existing types of boilers of that class. In designing this boiler, the object has been to reduce to a minimum the numerous fittings and parts liable to leak and bothersome to keep tight, as well as to economize in valuable space. The tubes being bent on one end, the replacing of same does not require a large space in front of the boiler, as the tubes have not to be taken out in a straight line. In the use of other boilers it is necessary to provide a fire-room almost as wide as the whole length of the boiler. This boiler can be set with a fire-room just large enough to handle the fire tools comfortably, and taking this into consideration, about 40 per cent. floor space can be saved, compared with other boilers of this class.

Another most important feature of this boiler is that there are absolutely no joints to keep tight, except necessary manholes for cleaning purposes. The bent tubes are arranged in what may be called a double bank system, either horizontally or somewhat inclined, expanded at their ends into sector shaped boxes made of steel, with butt strap joint and bumped heads of same material, and stayed accordingly. The rear box is fitted with a removable partition plate to collect the sediment; both boxes are connected to the steam drum by means of wrought iron necks, the rear neck being attached to a wrought iron cross drum, into which the last row of tubes are expanded.

Everything is arranged in this boiler to provide for an excellent circulation. The steam drum is filled only one-third with water, leaving two-thirds of its capacity for steam, which is superheated by the gases passing over the drum.

The illustration shows a 100 horse-power boiler now being constructed for a large paper mill in New York State. This boiler has no cast iron in the construction of its pressure parts, all being wrought iron or steel, and the whole structure being of a rigid form, yet allowing for free expansion, which makes it admirably adapted for marine purposes. For land purposes, it is set in brick-work similar to other boilers of its class, and, as there are no side exits, the boilers can be set side by side or in continuous batteries. The boiler is suspended independent from the brick-work from wrought iron beams resting on wrought iron columns, the front being of cast iron, and so arranged that at any time a special furnace or mechanical stoker can be attached without disturbing the upper part of the front. The tubes can be cleaned quite easily by using flexible or extension tube scrapers; from the outside by means of steam hose, which can be applied from the front and the rear. This boiler can be built for any pressure and size desired. It is manufactured by the Seller Water Tube Boiler Company, which has its offices in the Electrical Exchange Building, New York, and its own works at Watertown, N. Y. Mr. H. W. Seller, the well-known mechanical engineer, the inventor of these boilers, has designed some of the largest steam plants in existence.

The Weston Automatic Engine.

We present herewith a series of engravings illustrating the Weston automatic engine, built by the Weston Engine Company, of Painted Post, N. Y. Julian Scholl & Company, 40 Cortlandt street, are the New York city representatives. The bed of this

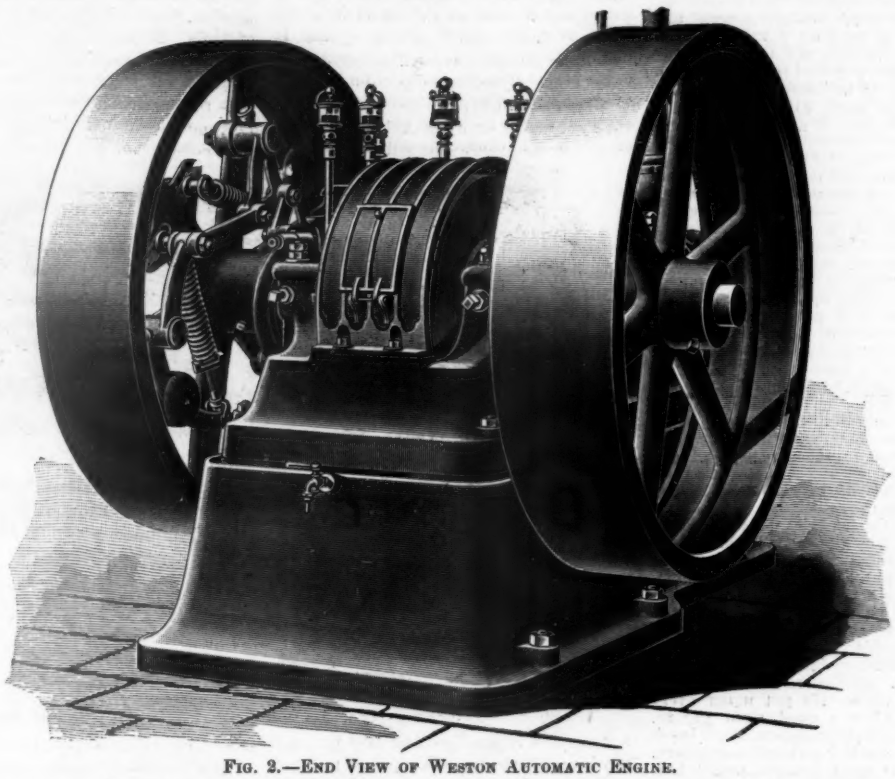


FIG. 2.—END VIEW OF WESTON AUTOMATIC ENGINE.

engine is made especially heavy, having interior ribs running across and lengthwise in sufficient number to make it absolutely rigid and positively proof against springing. The guides form a fixed portion of the bed. The cross-head shoe is adjustable to accommodate wear and preserve correct alignment. The cylinder and steam chest are in one casting and made from the best charcoal iron. The piston is made hollow, and cast-iron rings are sprung in for packing. The cast-iron jacket allows the cylinder to be covered on the outside with mineral wool to prevent radiation of heat. The parts are interchangeable. The valve, illustrated in Fig. 5, is a single casting, and works steam-tight between its seat and the heavy pressure plate. The steam being admitted to the center port (see Fig. 5) tends to lift the pressure plate away from the valve, an action which is opposed by springs resting against a set screw controlled by the hand-wheel on the outside. This permits of variation of tension and allows the release of the pressure plate from the valve in starting, thus preventing sticking after a period of disuse. The valve has four openings for the admission of steam, the length of each being the diameter of the cylinder, giving a high steam line and sharp cut-off. The exhaust is through a double opening. When, after a long use, leakage occurs, it is readily taken up by the adjustable pieces which support the pressure plate. These pieces are composed of two wedges, one of which is doweled to the steam chest face and has a projection on the end through which a set screw passes and enters the other wedge, thus permitting adjustment. The valve stem is packed only against exhaust steam, and will run indefinitely without repacking. In the piston rod stuffing box there is a large amount of packing, necessity for adjustment being avoided by permitting the gland to follow the wear under the pressure of the steam, a further advantage being obtained by allowing clearance between the glands and the stuffing box. The governor, shown in Fig. 6, has a laterally moving eccentric around the crank shaft which regulates the admission of steam, the variation being effected by centrifugally-acting weights connected by levers to the eccentric counter-balanced by centripetally-acting springs. With the governor at rest the springs will hold the eccentric in position of greatest throw, but in action the centrifugal force of the weights moves the eccentric across the shaft, reducing its throw with increased rapidity of motion, until it reaches the point where the valve travel will be in accordance with the amount of steam necessary to drive the load. It is obvious that under a variable load the centrifugal force of the weights and the tension of the spring will not remain uniformly balanced. The necessary adjustment is accomplished by shifting the end of both springs by means of a right and left hand screw controlled by a center adjusting nut, thus shifting both springs nearer to or farther from the pivotal points of the levers. The engine is set for the required speed before leaving the works, but if a change is necessary the weights may be adjusted toward the pivotal points of the levers for higher speeds, or reversely for lower speeds. The connecting rod illustrated in Fig. 7 is of forged steel. The cross-head end permits the brasses to be removed without taking out the pin. The end of the rod is cut out and fitted with a cap which may be tightened by two bolts. The brasses are adjusted for wear by a wedge regulated by an adjusting screw. Thus the brasses may be adjusted from one side only.

The oiling devices shown in Fig. 8 are very complete, every bearing being oiled from stationary sight feed oil cups, the oil wasting from the boxes on the inside being caught in annular rings on sides of crank disks, and passed to the crank pin through holes in the disk intended for that purpose, while on the eccentric side a snap ring is sprung over the crank shaft and extends inside of the eccentric, thus serving an additional means of lubricating that part, as the oil running to the ring is thrown off by centrifugal force and passes through holes in the eccentric to the eccentric strap. Oil falling over the cranks is caught by a guard and carried to the bottom of the bed, from which it can be removed and filtered.

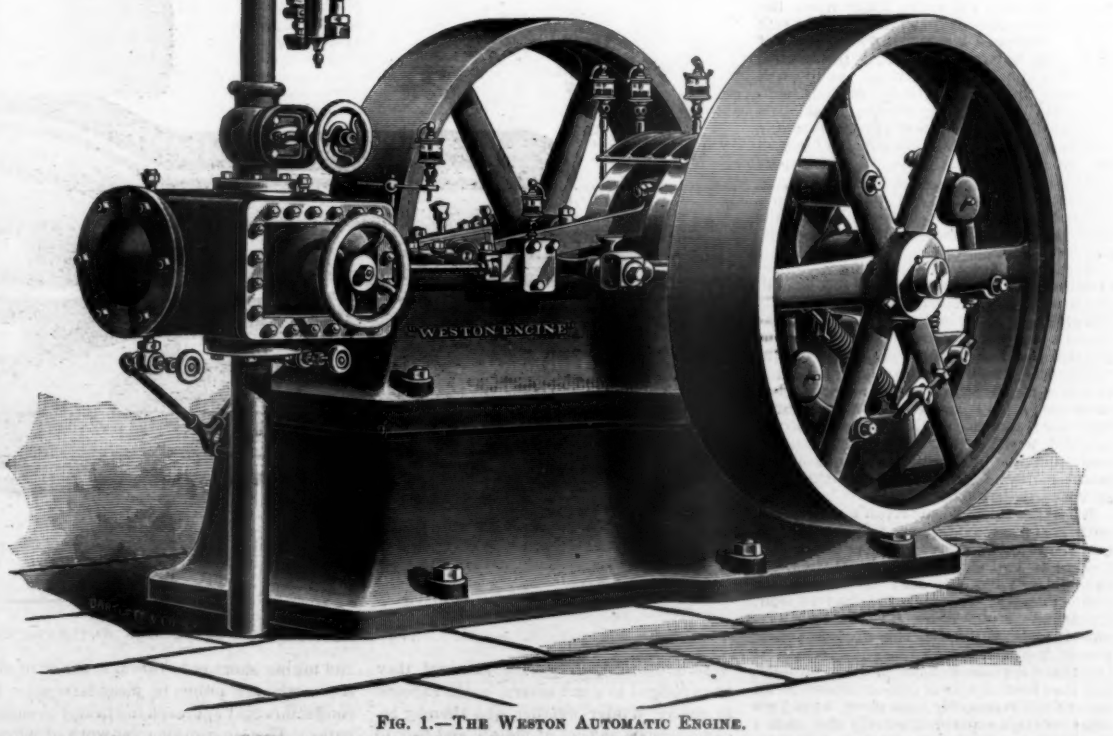


FIG. 1.—THE WESTON AUTOMATIC ENGINE.

The Air Gap in Dynamos.

At a meeting of the Institute of Electrical Engineers, on September 22, interesting remarks were made in discussion of Prof. Harris J. Ryan's paper "On the Regulation of the Air Gap and the Shape of the Poles to the Performance of Dynamo-Electric Machines." In view of the fact that most of the members present complained of having been unable, for lack of time, to consider the paper, it was decided to further discuss the paper at a future meeting. Mr. C. O. Mailloux, referring to the relation of air gap to sparking, said he found considerable difference of opinion; while theorists are telling us that we should not make the air gap too small and that we must have a certain minimum of resistance there, yet machines are being made which are very successful, not to say most successful, in which the air gap is exceedingly small. The Oerlikon dynamo works, in Switzerland, perhaps one of the most successful firms building dynamos in the world to-day, are noted for the extremely small air gap used in their dynamos; the armature iron being perforated near the edge and the wires passing through the perforations near the periphery of the armature, so that the air gap may be and is very small. Mr. Ravenshaw in England has cited some experiments with a given machine which he first tried with a very small air gap; he then bored out the field and tried the experiment over again, maintaining the same magnetic density through the entrefer. He found that it did not make any practical difference, so far as the limiting output of the machine within which sparkless running occurs was concerned.

He had in mind now some railway motors which were run with an air gap of scarcely a sixteenth of an inch and having armature teeth at that; the armature core itself having a low magnetic density (not exceeding 10,000 lines per square centimetre), and the machine was quite sparkless at any load for which it was designed.

Professor Anthony's experience did not indicate the necessity of making the air gap any larger than was necessary for getting in the wires, and, in fact, in a machine that he had recently constructed, he made an armature two feet in diameter for the very purpose of getting the wire in one layer. When the generator was running street cars, and the current was jumping from 0 to 200 am peres and back continually, it was almost impossible to tell by watching under the brushes when the generator was doing work. The creaking of the engine, etc., indicated it, and a man could imagine that he saw a little sparking when he heard the engine working. They were carbon brushes.

The chairman, Mr. T. D. Lockwood, thought that sparking in dynamos was largely due to a lack of harmony between the short-circuited current, as an individual coil passes under a brush and the current in that side of the multiple coil armature which the short-circuited coil is approaching. And that if we could produce at the moment when the front segment of the commutator leaves the brush a zero, by opposing the short-circuited current against the current to which the short-circuited coil is about to

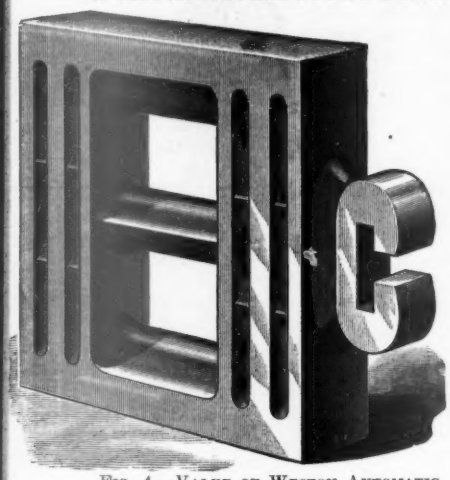


FIG. 4.—VALVE OF WESTON AUTOMATIC ENGINE.

be introduced, we should have a perfect neutralization and, in consequence, an absence of sparking. There has been a kind of hazy doctrine existing among electricians that the sparking upon a change of current, and when brushes were used to compensate for that change of current, is largely due to the fact that the neutral line had moved forward, and that, therefore, the brushes would have to be moved forward to catch up to the neutral line, and when the brushes did catch up with the neutral line the sparking would cease to exist. When you pursue that theory to its lair you find it is moving in a circle. He witnessed an experiment showing that in reality as the current in a series machine changed under a difference in load, the neutral line remained stationary as long as the brushes were not moved. A single wire was rigged around the armature. One end was attached to a fixed ring, while the other end was attached to a movable commutator, and the circuit of this wire included a telephone receiver. When the machine was working on a full load, a place was found where there was a zero of current. It was absolutely on the neutral line of the machine as it was working then. Just as long as the brushes were unmoved the telephone gave no sound, no matter how many lamps were put out or how much the current was changed, showing that the neutral line did not move. But when the brushes were moved forward to compensate for the increased current, it was found that there was a change, and that the neutral line did not move forward as it was supposed to do, but actually moved backward. He believed the gap has such a relation to sparking in the constant current machine only in so far as it may modify the form of the pole-pieces, and that "the requisite feature for a generator for constant current on closed coil armature in which regulation is effected by shifting the brushes, is that the field should be uniform throughout the range of movement of the brushes."

Mr. Nikola Tesla had constructed motors in which the air gap was often as low as $\frac{1}{4}$ of an inch at the start, and was gradually increased. This was the result arrived at: Up to a certain point the diminution of the air gap would act very favorably; then, the further approach of iron or the reduction of the air gap would begin to be a great drawback; and it had always been his idea that the real cause of that was the unsymmetrical position of the armature to the field, and the impossibility of making the motor so mechanically perfect that the pull on both sides would be equal.

Referring to Professor Ryan's experiment with a slotted field, he had found that directly projections are made upon a field a small air gap cannot be worked with. If the polar faces be smooth, no matter how close you approach the iron to iron, the armature undergoes a gradual change, but directly you have the grooves, each part of the armature surface has to get out from the very intense field, into a weak field, and then from the weak into an intense field, and so on, repeatedly, six times, as in Professor Ryan's experiments. He had made a great many experiments which confirm that. You can take a smooth field, put a laminated armature, without projections, in it and work with a certain magnetization revolving the armature at a given speed. It will not get hot to a high degree. Now, put in grooves through the field and you will find at once that with far less magnetization than before, the armature will get intensely hot. The reason is that you put each part of the armature through a much more sudden and greater total change and increase the frictional and current losses. That is the reason, also, that in the case of the grooves there is a certain increased loss in the voltage, attributed by Professor Ryan wholly to a different cause.

He had constructed constant current machines so as to produce a great rate of change in the current, and to replace the ohmic resistance required for steady work by impedance. In this manner an arc light machine can be made with only a single layer, no matter how large it is, and a constant current can be maintained within two or three per cent. without any external regulator. Take, for instance, a two pole machine with an armature of the greatest possible diameter. Instead of making the pole projections of the field smooth, make them with grooves parallel to the armature shaft; the more the better up to a certain point. Then wind the armature symmetrically with reference to the pole projections or grooves, so as to get a great rate of change in the current. There is a direct current, which is commutated just the same as in the Gramme machine, but as to the rate of change it is equivalent to a rapidly alternating current, and as the impedance through the whole circuit is increased to the extent that you can do away with the great ohmic resistance in the circuit, and can make the impedance and the armature reaction so great that no matter what the load is the current is the same.

In regard to the shape of the pole pieces, he had opportunity during the year 1885 to make some observations. He then worked at what is called the third brush regulation. It is a principle very interesting, but not very reliable. One of the difficulties was the excessive sparking of the third brush. To overcome this, the principal requisite was that the auxiliary brush should not bear on active coils. He then resorted to a means which was obvious. He put under every leading pole piece a good sized groove, which made the coils on each auxiliary brush comparatively inactive, so that the auxiliary, as well as the main brushes, would bear upon inactive coils. In this manner the sparking was obviated.

The case of the Narragansett Electric Lighting Company, of Providence, R. I., against Thomas Hand, Edward Smith and George E. Newell, of Pawtucket, has been decided in favor of the defendants upon every point involved in the trial. The case was brought to recover $3,700, the amount of a bond given by Mr. Hand to faithfully carry out and perform all the conditions of a contract to build a dynamo house for the electric light company. After the walls were built ready to receive the roof they were obliged to stand several weeks exposed to severe Winter weather, and thereby became warped and out of plumb, and had to be taken down and rebuilt. The company claimed it was Mr. Hand's fault. The case was on trial six days in the Court of Common Pleas and created considerable interest. The jury were out nearly six hours before a verdict was reached.

A Valuable Device.

PROTECTION OF TELEPHONE EXCHANGE SYSTEMS FROM THE INTERFERENCES DUE TO EXTRANEOUS CURRENTS.

TO THE EDITOR OF ELECTRICAL REVIEW:

The rapid development of the so-called strong current systems, and especially of the single overhead trolley railway system, is forcing the attention of telephone managers to the means at their command for counteracting the evil effects of leakage. As long as the wires of a telephone exchange system are operated in connection with the *earth* as a "common return," so long will the oversensitive telephones pick up and translate to the ears of the subscribers portions of the multitudinous electrical currents that are continually harrowing the bosom of mother earth. These electrical free lances spring from various sources, including dame nature's chemical laboratory, and inductive apparatus, telegraph, fire alarm and other electrical systems operated by currents from voltaic batteries, and the more annoying dynamo currents from electric lighting and power circuits. These various fugitive currents, either legitimately utilizing the earth as a portion of their circuits, or surreptitiously escaping from their metallic circuits and taking short cuts through the crust of the earth, are prone to meander over all conductors that approach too nearly to their paths. The labyrinthine net-work of wires that go to make up the plant of a metropolitan telephone exchange, connected as they usually are to the underground municipal gas and water mains, afford a specially inviting field of exploration for these erratic currents, to the serious detriment of the efficiency of the telephones.

No remedy for this state of affairs has yet been devised that does not require the abandonment of the earth as a "common return" for the telephone circuits, thus surrendering the disputed territory to the enemy, and isolating the telephones as far as possible from all association with earthy currents. In order to do this and yet maintain the telephone circuits intact and in a state of efficiency, it is necessary to resort to some form of metallic circuits. The simplest and the earliest form of metallic circuits consists of two separate and distinct

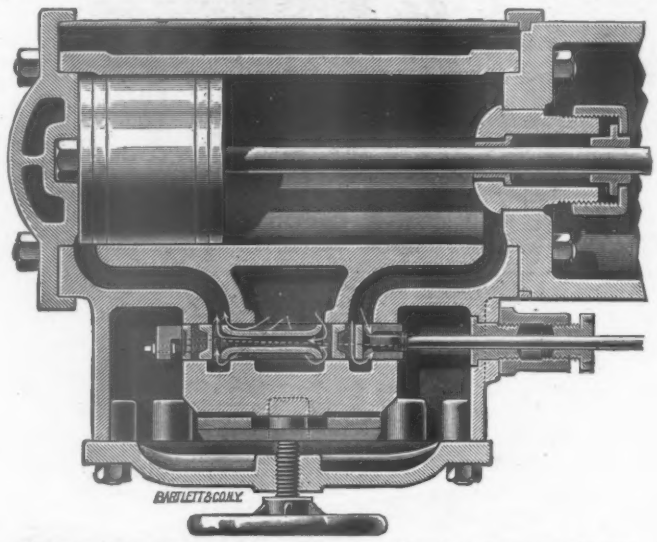


FIG. 5.—SECTION THROUGH CYLINDER OF WESTON AUTOMATIC ENGINE.

wires for every circuit, thus furnishing a separate return for each circuit, and necessarily doubling the total number of wires, and adding very materially to the complication, cost of construction, and expense of maintenance of the plant.

Recognizing the disadvantages and objections of the ordinary two-wire metallic circuit systems, I conceived the idea of substituting, in lieu of the earth as a "common return," one or more copper wires of large conductivity on a combination of common return wires, whose joint conductivity approaches that of the earth, to which all the direct or subscribers' wires are to be attached, instead of to the earth, thus forming a substitute for the earth, which I call an "artificial ground." As the circuits thus detached from the earth and attached to the metallic common return wire or wires instead, are purely metallic in their character, this device is also designated as a "compound metallic circuit system."

My claim is that perfect immunity is obtained by this device from the interferences

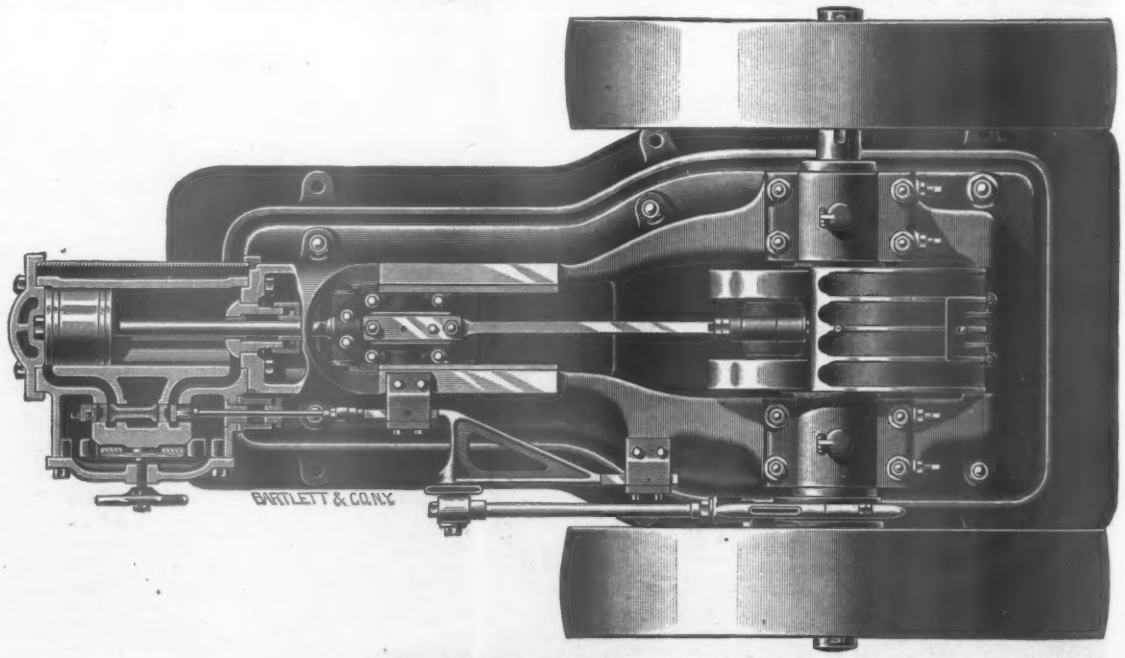


FIG. 3.—PLAN VIEW OF WESTON AUTOMATIC ENGINE.

that are so disastrous to earth connected telephone exchange systems, and at but a tithe of the cost of the ordinary two-wire metallic circuit systems, and so favorably has it commended itself to telephone managers in the United States, that many exchanges have been equipped with it. In every case where it has been intelligently introduced in accordance with the views of the inventor it has afforded the desired relief.

Domestic and French, Canadian and British, patents have recently been awarded the inventor for this device.

C. E. McCLUER.

Richmond, Va., Sept. 28, 1891.

Messages Sent to London and Replies Received in Four Minutes.

When a broker telegraphs his wife that he is not coming home for dinner he allows at least half an hour for the message to reach its destination, says the New York *Sun*. If it should get there in less time than that, and his wife telegraphs down-town to inquire the reason, he curses the rapidity of our telegraph service.

On the other hand, if the same broker cables his broker in London and doesn't get an answer in less than five minutes he considers himself an ill-used man. Incredible as this seems, it is a fact that a broker on the floor of the New York Stock Exchange can cable a message to his agent on the floor of the London Exchange and get an answer in four minutes. So important has this branch of the service become that there are now three operators who do nothing else than attend to this London stock business.

There are an average of 800 messages sent daily from New York between the hours of 10 and 12. Most of this business is confined to about a dozen brokers in either city, and their ciphers are as short as safety will allow. One letter stands for the firm's name, and the rest of the message is usually included in two sets of numerals.

These messages are sent by overland wire direct to Heart's Content, N. F., and are cabled from this point to Valentia, Ireland. Here they are transmitted by wire to the floor of the London Exchange. Messages are returned by the same route, and this complete circuit has been made in three minutes, although four minutes is the usual time. The price for this special service is the same as the regular service, 25 cents a word. The result has been to bring the New York and London markets so close together that either city feels the slightest fluctuation in the other market almost instantaneously.

A New Trade-Mark.

The Central Electric Company are out with a new trade-mark. The device represents the continent of North America faintly outlined on a disk, having the principal cities plainly shown all in connection with Chicago. The words "Central Electric Company" are boldly drawn across the continent, and the well-known trade-mark of the Okonite Company encircles the North and South poles. This "cannon ball" trade-mark will, no doubt, become as well known as the famous Okonite sign.

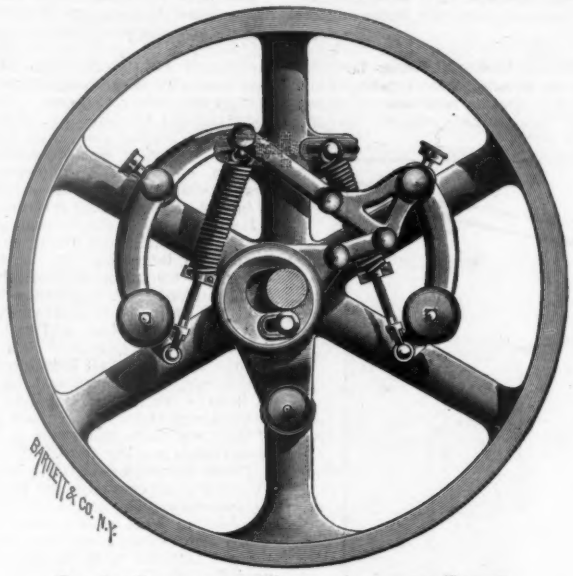


FIG. 6.—GOVERNOR OF WESTON AUTOMATIC ENGINE.

Electric Lighting in Coal Mines.

The H. C. Frick Coal and Coke Company, of Pittsburgh, Pa., the largest coal operators in the world, have just completed arrangements for the illumination of their many mines by electricity; in fact, the plans have already so far advanced that the lighting of two mining plants has been successfully accomplished. The contract for the work has been awarded to the Westinghouse Electric and Manufacturing Company, under whose supervision the work of installing the lighting plants were conducted. The first two mines to be lit by electric lights were the Leisenring No. 1 and the Leisenring No. 2. The operation of the lights was commenced a few days ago. Everything turned out to the greatest satisfaction of the Westinghouse and the Frick Companies.

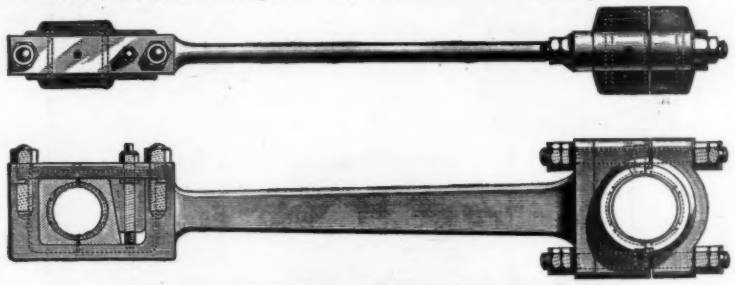


FIG. 7.—CONNECTING ROD OF WESTON AUTOMATIC ENGINE.

The mines of the company are mostly situated in the Connellsville region, in Westmoreland and Cambria counties, Pa., and a number of them are shaft mines, varying in depth from 100 to nearly 1,000 feet. Owing to the accumulation of fire-damp and gas in many of these mines, the lighting has always been a very grave problem, because almost every known method of illumination included the danger of causing the mine to catch fire. This led at last to the attempt of utilizing the electric current for lighting purposes. The wonderful success which was immediately established upon the first experiments is causing a rapid superseding of all other methods of lighting by the electric illumination.

The Westinghouse Company has been one of the first electrical corporations to realize the vastness of this field, and they commenced to pay attention to the subject of electricity in mines several years ago. The result has been that they have gained an experience in that branch of the business, the application of which has proved eminently successful. Many of the mines in Western Pennsylvania have installed Westinghouse apparatus, and not long ago the company completed the installation of a mine in the iron ore district of Lake Superior.

The Frick Company has adopted the method of lighting each mine independently, and at every mine is installed Westinghouse direct current apparatus of sufficient capacity to light up the mine below and above the ground. The lamps are distributed underground throughout the main walks leading to the shaft. In addition the tipple above ground, the engine house and other surface buildings are also lighted. The lamps vary in candle-power from 16 to 50.

Electric light plants are now being put up at Leisenring No. 3, Trotter and Standard mine—the latter, by the way, is said to be the largest coal mine in the world—but it will probably take a whole year before the plants for all the mines are installed.

Westinghouse.

A recent Pittsburgh dispatch states that the reorganization plan of the Westinghouse Electric and Manufacturing Company is now approaching completion. The committee, consisting of August Belmont, Brayton Ives and Charles Fairchild, have been diligently at work for several months, and matters have now been finally brought very near to a conclusion.

This reorganization has been accomplished by the voluntary action of all the parties in interest, and is comprehensive and satisfactory. The committee has caused the affairs and accounts of the company to be very carefully examined, and the result is that the perfection of the plan will provide for the company's floating debt and place it, by the absorption of the two minor companies, in a position to obliterate the fixed charges and greatly increase its assets and the compactness and economy of its organization.

These changes have been accomplished without any increase of the company's capital stock. On the contrary, an amount of about $1,000,000 of stock will remain in the treasury to meet the future wants of the business.

A Quick Telephone Removal.

The removal of the telephone exchange at Portland, Me., was effected last week in three minutes. The new exchange is equipped with modern switchboards and other labor-saving apparatus. The telephone business opened in Portland on September 1, 1879, with about 100 subscribers; in 1880 it was transferred from the Western Union Company to the National Bell, of Maine; a change of switchboard and office was made in 1880, and again to the quarters just vacated in May, 1883.

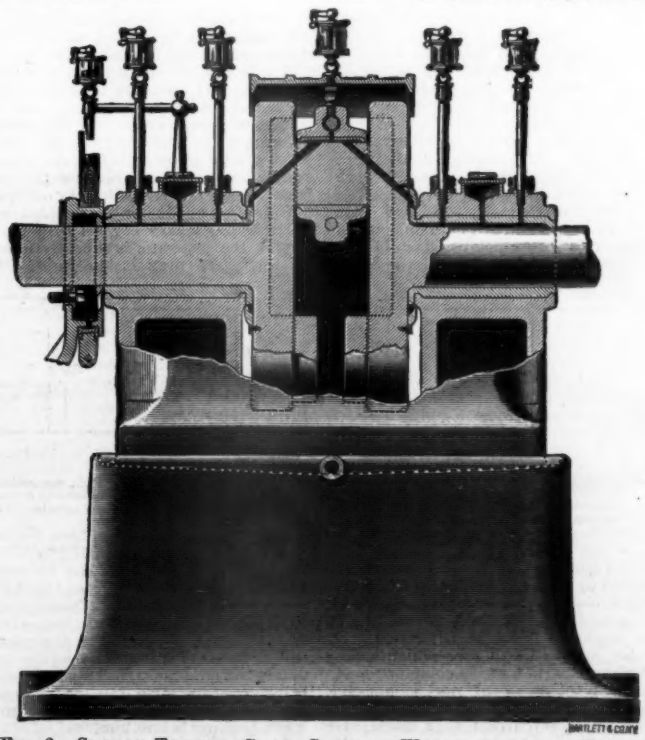


FIG. 8.—SECTION THROUGH CRANK SHAFT OF WESTON AUTOMATIC ENGINE.

C. H. Stickles, in charge of the construction of the electric light plant at Mount Vernon, Wash., has completed the work and turned over the plant to the Mount Vernon Electric Light Company.

The Bernstein Waterproof Socket.

Among the many necessities which have arisen in connection with the introduction of incandescent lighting for specific purposes, has been that of providing a lamp

BERNSTEIN ACID AND WATERPROOF SOCKET.

socket which is capable of successfully resisting the attacks of both acid fumes and moisture; the use of incandescent lamps in paper and pulp mills, breweries, chemical works and marine installations, having developed this want. The socket illustrated is manufactured by the Bernstein Electric Company, Boston, and, it is claimed, possesses characteristics which enable it to fill the above requirements. This socket as at present made is adapted for lamps capped for the Thomson-Houston socket, though by slight mechanical modifications it can easily be adapted for other standard caps; it consists of two solid parts of hard rubber, to one of which leading in wires are sealed by a waterproof and acid-proof material, and to which the lamp is attached; between this part and the remaining part of the socket a rubber gasket is inserted at "a," and another is placed on the lamp collar at "b." When the upper rubber piece is firmly screwed into place these rubber gaskets are so compressed as to make the joints absolutely tight.

The Bernstein Electric Company have used hard rubber instead of porcelain in order to obtain a socket of great durability, as well as on account of the superior strength of hard rubber to be able to produce more graceful lines than the use of porcelain permits, and at the same time to avoid the danger of breakage in use and in installing and transportation.

A Solution of the Block Signal Problem.

BY H. WARD LEONARD IN THE "ENGINEERING MAGAZINE."

The attention of the public has been forcibly attracted of late to the importance of efficient automatic block signals by the recent terrible accident in the heart of New York city. Either the failure of the signal or the failure of the engineer of the following train to observe the signal was the cause of this, as has been the case in many other similar accidents.

About three years ago the writer suggested a block system which, it is believed, would comply with all the requirements of an efficient system, and, with the hope that it may lead to improvements in practice, the following description of it is offered:

Divide the line of the railway into blocks of, say, one mile long. Make each block overlap the next one half-way. Stretch a bare wire parallel to the track and continuous along each block. Thus a wire one mile long will start from the beginning of each block and another parallel to the first will start at the center of the first. There will thus always be two parallel conductors along the track and a conductor will end and a new one begin at each half mile. The forward end of each mile length of conductor will be connected by a wire leading to a green incandescent lamp, and the other terminal of the lamp will connect with the ground. Similarly the rear end of each conductor will connect with a red incandescent lamp.

Upon each locomotive will be placed a generator of electricity of about 100 volts; that is, about the pressure of the incandescent lamps. This generator can be a battery or, preferably, a small dynamo, driven by a small engine which is operated by steam from the locomotive boiler. One pole of this generator is grounded by making contact with the metal work of the locomotive. A conductor leading from the other pole of the generator passes through an ampere meter for indicating the current being generated, and thence on through a low resistance series incandescent lamp, which, when supplied with the current of four of the track signal *lamps*, will operate at a moderate incandescence. After passing through the series lamp, which we may call the pilot lamp, the current passes to a trolley carrying a large wheel made after the style of a bicycle wheel, and this wheel makes rolling contact by a concave rim upon the two parallel conductors stretched along the track.

Now, it will be evident that if the generator be operated the electric current will pass through the pilot lamp and up the trolley to the two conductors; thence it will divide equally between the four lamps connected to these two conductors, passing through two green lamps ahead of the trolley, and through two red lamps to the rear of the trolley, the green lamps as well as the red being half a mile apart.

As the train moves forward the trolley will finally roll off the conductor of the block it is leaving, and both the red and green lamp of that block will be extinguished. At the same time the trolley will roll onto a new block, and the red lamp at the rear end of this block will light up just as the locomotive reaches it and will then pass to the rear. At the same time the green lamp at the forward end of this new block will light up at a distance of one mile off.

It will be seen that the following train would have to pass the two red lamps of the preceding train before a collision could take place; also, that whenever two trains would get within a mile of each other the generators would be acting in concert to divide the combined loads of the two, and whatever the current of each had been previously, it would immediately become different, the generator having the higher pressure taking the larger portion of the combined load. Thus the pilot lamp of one locomotive would flash up and its ampere meter would indicate a greater current than usual, and this, by a contact on the ampere meter needle, would cause an alarm bell to ring in the cab. Similarly the pilot lamp of the other locomotive would be reduced in candle-power, the ampere meter would show a reduced current and the alarm would ring on the lower contact. At the same time the locomotive engineer of the following train would see before him the red lamps of the preceding train in addition to his own green lamps, and a rear guard on the preceding train would see, in addition to the red lamps of his own train, the green lamps of the following train. On each locomotive a line containing a high resistance is led from the trolley and around the generator to ground, and this circuit in shunt to the generator contains a telephone. It will thus be possible for either locomotive engineer to talk to another engineer preceding or following in the same block, and regardless of whether either or both are in motion. If telephones in the various stations be similarly connected from the signal conductors, communication can be carried on between the station master and passing trains.

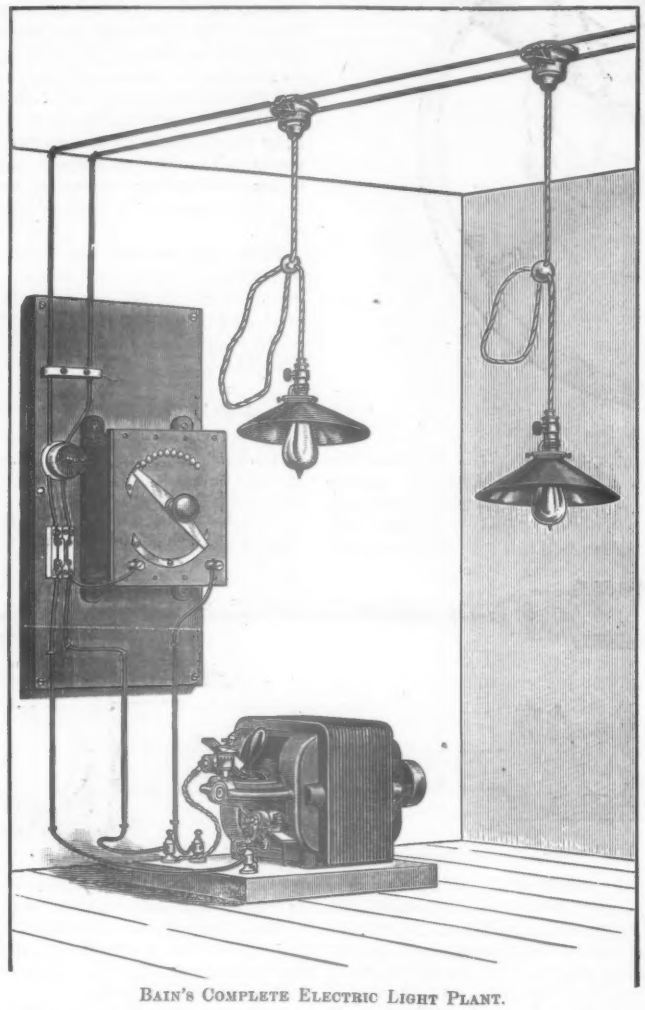
If it be desirable to stop an approaching train, it is only necessary to interrupt one of the signal conductors or connect the two together, or ground either. If the conductor be broken or disconnected, the engineer when a mile away finds his pilot lamp dim and his alarm ringing, because the current from his generator is reduced by one-quarter.

If a signal conductor be grounded, as soon as the trolley makes contact with that conductor the generator is short-circuited, and its pilot lamp first flashes up brightly and the bell rings, and then the current runs down rapidly and the bell rings by the lower contact. If the two conductors be crossed, the load of two more signal lamps is added to the normal load of the generator, and this increase of 50 per cent. in the current makes the pilot lamp flash up and the alarm bell ring, at the same time the engineer sees the red lamp of the abnormally supplied block burning before him.

If a train breaks down its generator, it keeps its trolley on the wires as before, and as soon as it gets into a block with another train, its pilot lamp lights and the alarm rings.

If the other train be preceding, its two rear red lamps also signal danger to the following disabled train, and the engineer of the preceding train also receives a danger signal by its alarm bell and the increased current of its pilot lamp. If the disabled train is followed by another into the same block, an abnormal red signal is set between the two trains, green lamps light up in advance of the disabled train and the pilot lamp and alarm on both the trains indicate danger.

If two trains near each other both had their apparatus broken down, both would, of course, be moving very cautiously and endeavoring to ring the telephone call of any other train which might come into the same block with them.



BAIN'S COMPLETE ELECTRIC LIGHT PLANT.

A misplaced switch would make a contact which would light a red lamp in front of an approaching train.

Now, as regards the signals along the track, the incandescent lamps should be arranged in a proper signal box, and the green lamp should show a vertical band of green light, whereas the red lamp should show a horizontal band of red light, thus giving a signal defined by both form and color.

Two possible objections which may be raised against this method of signaling are:

First. The presence of a car on the track without any accompanying attendant would not give a danger signal as it would with a track circuit system. This, however, is a rather remote contingency, and in any event could not lead to an accident with much loss of life. The unreliability of the track circuit is so great in other ways as to make this single defect almost negligible by comparison.

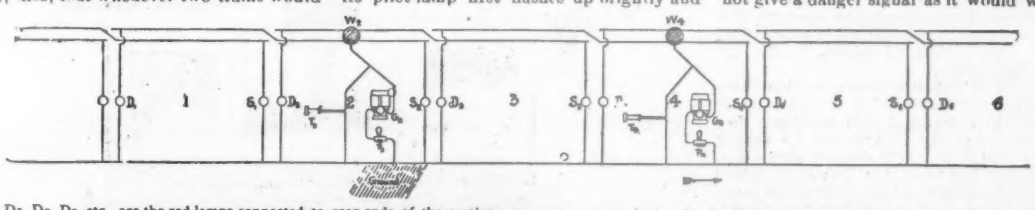
Second. The action of sleet might interfere with the action of the signal by preventing electrical contact between the trolley and wire. This trouble would be rare, in any event, and it is not likely to occur, as the heating effect of the strong current on the wire would tend to eliminate this trouble, just as it does with electric railway systems. If, however, it became necessary to provide against this, it could be done by placing the conductors beneath a semi-circular structure, such as a tube sawed longitudinally and concave downward.

It will be evident, by examining the specification as to the requirements of a safe system, that this plan avoids the defects of the present system.

The next consideration is as to its first cost and maintenance, and it will be evident that the advantages on these points are conspicuously in its favor, for the simplicity of the signals and the cheapness of the small bare conductor makes its first cost less than that of any existing system. The cost of operating will be almost *nil*, as there will be almost no need of inspecting signals, having no batteries, electro-magnets, relays, weights, clockwork, compressed air, oil lamps, or the various other possible causes of failure of the existing systems.

It will be evident that by connecting along the signal conductors white incandescent lamps, and increasing the size of the generator, the track can be perfectly and uniformly lighted both in advance of and behind the train as it moves forward; and that also all crossings and stations can be lighted while a train is within a mile of them. Two-and-a-half horse-power would, in this way, be all that would be necessary to keep a track illuminated by 16 candle-power lamps every 200 feet, and for a space of not less than half a mile in both directions from a moving train.

Trains having an electric plant for illumination of the cars require a plant of about 15 horse-power, so that the additional power required in such a case would be hardly worth mentioning, and no special generator beyond that for train lighting would be needed.



D1, D2, D3, etc., are the red lamps connected to rear ends of the sections 1, 2, 3, etc., respectively. S1, S2, S3, etc., are the green lamps connected to the forward ends of the sections 1, 2, 3, etc., respectively. G2 and G4 are the generators on trains in sections 2 and 4 respectively. P2 and P4 are the Pilot lamps in series with the generators and placed in the locomotive cabs. T2 and T4 are the telephones. W2 and W4 are the trolley wheels making connection between the signal conductors and the generators.

Under the conditions shown in the diagram the train in section 2 will light its Pilot Lamp P2, the forward green lamps S2 and S3 and the rear red lamps D2 and D3. The preceding train in section 4 will light its Pilot Lamp P4 and the forward green lamps S4 and S5 and the rear red lamps D4 and D3.

Bain Complete Electric Light Plant.

Our illustration is a reproduction of one of the Bain complete electric light plants, capacity 10 lights, wired, connected and ready to set up without the aid of an electrician. The apparatus is designed for practical every-day use, is simplified by leaving off every superfluous feature, and is also cheap (in price only). The generators are most reliably made. With an ordinarily good gas or gasoline engine one of the 20 light equipments can be run to its full capacity for at least four hours per day for an average of about $4 per month. The entire equipments are manufactured and sold by the Bain Electric Manufacturing Company, Chicago.

LITERARY.

"Proceedings of the United States Naval Institute," No. 59, has come to hand.

"Reports from the Consuls of the United States," for June, 1891, has been received.

"Reports from the Consuls of the United States" for July, 1891, has been received.

"The Brooklyn Institute Prospectus," for 1891–92 has been received. The usual courses of study, extended and improved, are laid down.

We have received from Mr. Oberlin Smith, the author, two pamphlets, "The Engineer as a Scholar and a Gentleman," and "Possibilities of Applied Science."

E. C. Martin, a thoughtful journalist and essayist, and several times a contributor to *Scribner's*, has a sympathetic and discriminating article on "Carlyle's Politics" in the October number of that magazine.

"Electrical Possibilities on Staten Island," a speech by Mr. Erastus Wiman, advocating electric railways for the island, has been received. Mr. Wiman gives some interesting data and employs convincing arguments.

In its November number the *Cosmopolitan* will publish a series of letters written by Gen. W. T. Sherman to one of his young daughters, between the years 1859 and 1865, and covering most of the important events of the war of secession.

As was expected, the greatest interest has been exhibited in the new story by Amélie Rives which was begun in the August number of the *Cosmopolitan*. The second part appears in the September number and the story will close in the following issue.

"Abstract of the Proceedings of the Society of Arts," for 1890–91, has been received from the Massachusetts Institute of Technology. Professor Cross' article on "A New Method of Study in Telephony," has already appeared in full in the ELECTRICAL REVIEW.

The October *Century* will contain a frontispiece portrait of Rudyard Kipling and an article on his work by Edmund Gosse. Mr. Gosse says that Kipling was born in Bombay, in Christmas week, 1865, and is, therefore, only in his twenty-sixth year.

"South-Side Virginia," and the *Public Opinion* prize essays on "The Industrial Future of the South," have been received from Mr. Chas. G. Eddy, vice-president of the Norfolk and Western Railroad. Many interesting and useful bits of information about the South are contained in these pamphlets.

Mr. Allen R. Foote, Special Census Agent, has sent us a bound volume of the schedules used in collecting the statistics of the electrical industries for the 11th census. They make a book which will be of increasing historical value, because they are carefully prepared and may be considered models of their kind.

Rudyard Kipling's new novel, written in collaboration with Wolcott Balestier, for *The Century*, is entitled "The Naulahka, a Tale of West and East." It is a story of America and India. The principal characters live in a "booming" Colorado town, where the story opens, but the scene quickly shifts to the court of an Indian maharajah, whither the hero and heroine journey to meet with most varied experiences. The story will begin in the November *Century*.

The Club is the name of a beautiful little monthly devoted to the affairs of men's and women's clubs. The first issue, that for September, is excellently printed on fine paper and artistically illustrated. News from the New York Electric Club occupies a prominent position. Messrs. A. Frank Richardson, the well known advertising agent, and H. C. Brown, publisher of *Art in Advertising*, are responsible for the appearance of *The Club*. The new venture deserves success and will undoubtedly attain it in such competent hands.

Scribner's Magazine for October is led by the fourth article in the series on "Great Streets of the World." Mr. W. W. Story, the eminent American sculptor and writer, who has spent the most of his life in that city, writes of "The Corso of Rome," recalling its mediæval glories, and giving many personal reminiscences of his sojourn there, with picturesque descriptions of the street as it exists at the present day, its palaces, monuments, churches and public buildings, and a vivid account of the Carnival in its gayest days—the races of the Barberi and the closing night, when thousands of wax tapers are lighted and carried about the street.

Those who have seen the autobiography of Ben Butler so far as it is completed assert that it is full of spicy reading. The chapter of it, which the *New England Magazine*, for October, by special arrangement with the publishers, brings out in advance of the publication of the book, reveals the boyhood life of Butler. It contains illustrations of his early home, his mother, himself as a young man, Waterville College, which he attended. Read between the lines, one cannot fail to see the influences which were working to bring out the Ben Butler of later years. He was the same Butler in boyhood that has been so prominent and progressive ever since.

As science has advanced its sub-divisions have multiplied. Specialism has increased, and for even a scientist to cover the whole scientific field has long since become an impossibility. The intelligent layman, therefore, stands in greater need than ever before of instruction put in convenient form. This want is supplied by the new "Modern Scientific Series," edited by Sir John Lubbock, which is to be published by D. Appleton & Company. This series will present the results of modern scientific investigation in clear, concise, readable form. Each volume will be complete in itself and will contain about 200 pages. The first volume in the series will be "The Cause of the Ice Age," by Sir Henry Bell.

The element of timeliness is predominant in the first three articles in the October *North American Review*. The first of them (in two parts) deals with that most interesting question, "Can We Make It Rain?" An affirmative answer is furnished by General Robert G. Dyrenforth, who had charge of the recent rain-making experiments in Texas. He describes in detail what was done there, pronounces the experiments a success, and concludes that the making of rain by explosions of powder and dynamite is practicable and not excessively expensive. The negative side is strongly put by Prof. Simon Newcomb, who contends that sound can produce no changes in the atmosphere or clouds and can have no influence in causing rain. The cause and progress of the civil war in Chili are described by Capt. José Ma. Santa Cruz, late commander of the Chilian man-of-war "Huascar," who has been in this country as a representative of the now successful congressional party. "Speculation in Wheat" is discussed with full knowledge by the famous grain speculator, B. P. Hutchinson, who tells about wheat "corners" and the effect of the recent ukase in Russia against the exportation of rye.

FIG. 1.—FRINK'S REFLECTING ELECTROLIERS.

A Novel Electric Railway for the World's Fair Grounds.

October 7 next the World's Fair grounds at Chicago will be opened to visitors for the inspection of the progressing work, and for their accommodation there is being constructed an electric railway of a most ingenious and novel character, having a capacity to carry 30,000 passengers per hour, with the greatest comfort, convenience and safety. The railway department of the Chicago office of the Thomson-Houston Electric Company have closed a contract with the Columbian Movable Sidewalk Company, of Chicago, for the electrical and steam equipment of the movable sidewalk which is now being installed. The mechanical and electrical plans and details have been carefully worked out by Mr. G. K. Wheeler, of the company, and under his supervision the entire plant will be installed.

By the time named above there will have been nearly completed a large number of buildings, and there will be much to attract and interest visitors. The electric railway, however, will be one of the leading novelties and attractions. This railway will differ from ordinary railways, in that the passengers are transported on a movable sidewalk instead of box cars of the ordinary type. The scheme is the invention of the Columbian Movable Sidewalk Company, of Chicago, and is being constructed under their patents.

This sidewalk is located on the improved and unimproved portions of Jackson Park, and is to be constructed on an elevated structure 25 feet high and 900 feet long, in the form of an ellipse, and is to consist of 75 cars, each 12 feet long, connected together, making one solid train. There are to be constructed two parallel sidewalks, one running at the rate of two miles an hour, the other at four, both walks moving in the same direction. The passengers can step from the stationary walk to the one which moves at the rate of two miles an hour, and if it is desired to move at a greater speed, they can step from this walk to the one running at four miles per hour. The passengers can safely walk upon either of the movable sidewalks while in motion if desired.

The structure will be illuminated at night by a number of Thomson-Houston incandescent lights, and as the grounds are to be illuminated with arc lights, a satisfactory view thereof can be obtained during the evening as well as during the day.

Three of the 75 cars are to be equipped with two 15 horse-power Thomson-Houston railway motors each, mounted upon trucks with wheels 18 inches in diameter. As the car platform or sidewalk is arranged it is perfectfully level with the stationary walk, allowing the trolley wire to be placed beneath the surface of the platform, and the current taken therefrom by means of small trolleys attached beneath the car floors.

The operation of this train of cars will be arranged in a novel manner, doing away with the use of motor-men, the entire train being controlled and operated by one man. There will be constructed at a central point at one side of the track a controlling station, which will contain a main switch, reversing switch, automatic circuit breaker, lightning arrester, ampere meter and rheostats, all arranged so that they can be operated by the attendant from that point, who will have the train under perfect control. As an additional safeguard, push-buttons will be arranged at 12 equidistant points along the line of track, which will be connected with an electric bell and the circuit breaker in the controlling station, and in case of accident to any of the mechanism of the train, an attendant can, by pressing the button, automatically open the circuit at the station and stop the train instantly, without the assistance of the operator.

The power for the operation of the sidewalk will be furnished by a Thomson-Houston 110 horse-power multipolar compound wound railway generator, located in a power house adjacent to the track. In connection with the generator there will be placed a suitable switchboard, regulating, controlling and indicating devices of Thomson-Houston Company's manufacture.

BOOK REVIEW.

A handsome book of 400 pages has been printed by the Thomson-Houston Electric Company, containing a number of selected United States patents relating to electric railways owned or controlled by the company. The whole number of patents owned by this company is stated to be nearly 1,200 United States patents, of which about 500 relate especially to electric railways. The volume contains 82 of the most important patents selected from those relating to railways. The patentees are Charles J. Van Depoele, E. M. Bentley, Walter H. Knight, Professor Elihu Thomson, Charles F. Brush, and E. W. Rice, Jr. The work is a model of typographic beauty, and contains *fac-simile* reproductions of the drawings and text, in full, of the patents. It will prove highly valuable as a work of reference, in giving full information relating to the several railway patents which constitute the stronghold of the Thomson-Houston Company. The book also contains a list of the suits now pending in the United States Circuit Courts brought by the Thomson-Houston Electric Company against infringers.

Reflectors and Electroliers.

We presume most of us have sat under and observed in the public buildings, churches, etc.. the artistic and efficient reflectors manufactured by the old established firm of I. P. Frink & Company, of 551 Pearl street, New York city. The writer has a vivid recollection of his early boyhood, when, as was his custom, he was wont to engage in worship in the meeting-house. Tiring of close application to the dominie's sermon, he would glance up to the beautiful reflectors for consolation. I. P. Frink made the reflectors and chandeliers in those days and is making them to-day. We presume that this concern would hesitate in showing some of the old designs which were used in "ye olden time," for the contrast with present styles, such as appear in this issue of the REVIEW, would be too marked. The firm of I. P. Frink was established in 1852, and furnishes some of the largest theatres, churches and public buildings, as well as fitting the homes of some of our most influential citizens. This company's warerooms present a scene of interest and are constantly visited. Just now an attractive catalogue is being sent to all who ask for it.

FIG. 2.—FRINK'S REFLECTING ELECTROLIERS.

Editor Bennett Doesn't Like Dolls.

[From the *Evening Telegram*.]

The Electric Club is discussing rapid transit. Good. Enough of talking dolls.

KINDRED INTERESTS

Jerome and Harvey Redding have retired from the Redding Electric Company and will in future carry on the manufacture of their specialties at the old stand, 48 Hanover street, Boston. They intend to manufacture their well-known Disque batteries in larger quantities than ever before, and with increased facilities they will be able to sell all supplies at lower prices than in the past.

James W. Queen & Company, Philadelphia, have issued a third edition of their catalogue I–66 describing electrical testing apparatus and accessories. Among other valuable devices described are Queen's magnetic vane ammeters, and voltmeters, hot wire voltmeters, electro-dynamometers, portable galvanometers, portable testing sets, electric light photometers, and Brackett's cradle dynamometer. This catalogue is, we believe, the most complete of its kind ever published in this country.

Alexander, Barney & Chapin, 20 Cortlandt street, New York, complete their first year of business this week. The company report that they have had to increase their salesroom and storage facilities and number of employés several times. They also say they are more than satisfied with the actual and prospective business. In addition to their present large stock, they are arranging to take up electric railway supplies, making a feature of a new form of the well known "A. B. C." incandescent lamp specially adapted for railway work.

The Electric Merchandise Company, Chicago, report for the last week the closing of contracts for the complete equipment of electric roads at Defiance, Ohio, and Negaunee and Ishpeming, Mich. The superiority of the equipment manufactured by this old and reliable company is recognized by both parent electric companies and construction companies, as well as practical street railway managers. They also report during the same period orders for the Burton electric heater from roads in Amsterdam, N. Y.; West Superior, Wis.; Milwaukee, Wis.; Escanaba, Mich.; Defiance, Ohio; Dallas, Texas; Newton, Mass.; Champaign, Ill.; Helena, Mont., and Ann Arbor, Mich.

The Rollason Gas Engine.—We are in receipt of a catalogue of the Electric Manufacturing and Gas Engine Company, of Greenbush, N. Y., who are the sole manufacturers in the United States of the Rollason gas engine. We are hearing nowadays a good deal about gas engines. They are commanding attention on account of their economy and convenience. The Rollason is evidently the best of the times in regard to efficiency. Any one interested who will drop in at the general offices and warerooms of the company, at No. 134 Liberty street, and see Mr. H. W. Harris, general manager, we will guarantee will learn something of value about gas engines in general and the Rollason in particular. Any friend out of town who cannot make it convenient to call on Mr. Harris, can obtain, by writing for it, an admirable catalogue full of artistic cuts and suggestions.

REDUCTION IN RATES.

Commencing October 1st, the Providence and Stonington Steamship Company will reduce rates to all points on both its lines, viz: The Providence Line, from Pier 29, N. R., at 6.00 P. M., and the Stonington Line, from New Pier 36, N. R., at 5.00 P. M. First-class rates to principal points will be the same on both lines, as follows: Boston, $3.00; Providence, $2.25; Worcester, $2.25.

WANTED.—ELECTRICIAN. A manufacturing concern in Chicago, having large isolated plant, want to engage a competent man to take charge of same. Must be not over 40 years old, acquainted with leading systems of arc and incandescent lighting, competent to lay out and do new wiring, and a good all-around man.

Please address in own handwriting, stating full particulars as to age, experience, salary wanted, etc.

"MANUFACTURER,"
Care of ELECTRICAL REVIEW,
435 "The Rookery," Chicago, Ill.

THE LAW
Double Cylinder Battery.

Surface of negative elementandquantity of solution double that found in any other open circuit cell.

Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

PATENT PERFORATED
ELECTRIC LEATHER BELTING

MANUFACTURED BY
Charles A. Schieren & Co.,
45, 47, 49, 51 FERRY ST.,
COR. CLIFF ST.

BRANCHES:
BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

Burnley Dry Battery
PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market.
BETTER than any other Dry Battery yet produced.
Most compact in size and cheapest. 90 cents per cell.
Discount to the Trade and in quantities.

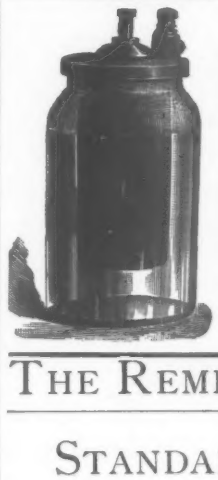
J. H. BUNNELL & CO.,
Sole Manufacturers and General Agents,
76 CORTLANDT ST., N. Y.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 20 ft.; 108 in. x 22 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.
20 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ½ in. to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
1 New Horizontal Boring Machine. Newark Machine Tool Co.

Send for List of New and Second-Hand Machinery in Stock.

PRENTISS TOOL & SUPPLY CO., P. O. Box 3362.
115 Liberty Street, New York.



LITTLE GIANT.
R. I. Telephone & Electric Co.,
Providence, R. I.

THE REMINGTON
STANDARD
TYPEWRITER

Is to-day, as it has ever been, the leading Typewriter.

Carefully tested improvements are constantly added to this famous machine.

Send for Illustrated Catalogue.

Try Our Paragon Brand of Typewriter Ribbons

Wyckoff, Seamans & Benedict.
327 Broadway, New York.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON SEPTEMBER 29, 1891.

460,109 Telegraphic transmitting instrument. 460,110 460,111 Telegraphic instrument; Charles G. Burke, Richmond Hill, N. Y.
460,122 Process of and apparatus for generating electricity; Thomas A. Edison, Menlo Park, N. J.
460,123 Phonogram blank carrier; Thomas A. Edison, Llewellyn Park, N. J.
460,125 Dynamo or electric motor; William M. Fink, Elizabeth, N. J.
460,140 Electric safety catch; John W. Howell, Newark, N. J.
460,163 Trolley for electric railways; Frederic F. Smith, Woburn, Mass.
460,178 Hanger for incandescent lamps; James A. Matteson, River Point, R. I.
460,199 Circuit controlling apparatus; John P. Cushing and William J. Kelly, Boston, Mass.
460,235 Electrode for secondary batteries; John B. McDonald, Chicago, Ill.
460,245 Switch for series dynamo-electric machines; Craig R. Arnold, Sharon Hill, Pa.
460,277 Method of obtaining fluids for primary batteries; Joseph B. Gardiner, Nyack, N. Y.
460,287 Electric alarm; Charles H. Shaffer, Rockford, Ill., assignor to the Electric Alarm Co., Muskegon, Mich.
460,289 Lightning arrester; James J. Wood, Brooklyn, N. Y.
460,326 Printing telegraph. 460,457 Printing telegraph instrument; John E. Wright, New York.
460,349 Printing telegraphic apparatus; Gilbert A. Cassagnes, Paris, France.
460,354 Apparatus for electrolytically separating metals from ores; Werner von Siemens, Berlin, Germany, assignor to Siemens & Halske.
460,364 System of electrical distribution; Edward W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.
460,373 Dynamo; William H. Elkins, Cambridge, Mass., assignor, by direct and mesne assignments, to the American Electric Machine Co., Portland, Me.
460,391 Electric lock; William S. Hull, Sheffield, Ala.
460,428 Method of soldering or brazing by electricity; Charles L. Coffin, Detroit, Mich.
460,443 Insulator; Frank A. Ross, Livingston, Mont.
460,464 Automatic electric fire alarm system; William S. Cook, Moses C. Cook and Albert H. Morrow, South Omaha, Neb.
460,488 Trolley switch; Harry L. Pierce, Leominster, Mass.
460,492 Combined cash register and phonograph; Austin B. Hayden, Kansas City, Mo., assignor to the Hayden Articulating Cash Register Co., of Missouri.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

FOR SALE.

DYNAMO AND LAMPS. $650 will buy one Schuyler 45-light arc dynamo and lamps. This machine is in first-class order. Correspondence solicited.
JAMES B. McGIFFERT, Supt.,
149 Public Lane,
ELIZABETH, N. J.

IF YOU HAVE A
CHURCH, HALL, ART GALLERY OR PUBLIC BUILDING
TO LIGHT BY ELECTRICITY
Why not secure the benefit of a large experience and obtain correct information in regard to the proper diffusion of light by conferring with
I. P. FRINK.
ESTABLISHED 1857. 551 PEARL ST. N.Y.
Estimates and Special Designs for REFLECTOLIERS Furnished upon request.
SEND FOR CATALOGUE.

THE ELECTRICAL ENGINEERING COMPANY,
Contractors for Complete Arc, Incandescent and ower Plants.
ROOM 603, MONON BLOCK, 320 DEARBORN ST., CHICAGO, ILL.
Superintending Electrical Construction, and Advice on Electrical and Mechanical Subjects a Specialty.

THE WADDELL-ENTZ ELECTRIC CO., 302 PRODUCE EXCHANGE, NEW YORK

Manufacture Improved Slow-Speed Generators and Motors for all purposes, both "Belt-Driven" and "Direct-Coupled." SOLE MANUFACTURER of new type "DIRECT-DRIVEN" Generators for Electric Lighting and Power, Combining Economy of Floor Space and ABSENCE OF BELTS with very Slow Speed, ABSOLUTE NOISELESSNESS, Simplicity, Strength, Durability, High Efficiency, Low Running Expense. Estimates furnished. ELECTRIC TRACTION EQUIPMENTS with Secondary Batteries. Durable, Efficient and Economical. Street Car Motors. Insulated Wire, Cables and Flexible Cords. SPECIAL ELECTRICAL MACHINES DESIGNED.

FACTORY AT BRIDGEPORT, CONN.

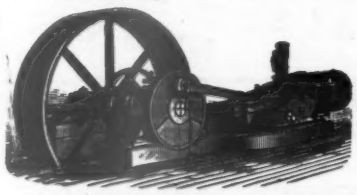
THE BEST FILING CABINETS For LETTERS AND DOCUMENTS Send to THE GLOBE COMPANY For illustrated catalogue CINCINNATI AND NEW YORK.

OUR PLATES ARE MADE BY THE ELECTRO LIGHT ENGRAVING CO., 157 & 159 WILLIAM ST., TO WHOM WE RECOMMEND ALL WANTING GOOD WORK AND DONE PROMPTLY

PUBLISHERS OF "ELECTRICAL REVIEW."

BUCKEYE AUTOMATIC CUT-OFF ENGINES.

Slow Speed, Medium Speed and High Speed Engines.



SIMPLE, COMPOUND AND TRIPLE.

Expansion Engines. High Pressure Boilers.

Complete Steam Power Plants of Highest Attainable Efficiency.

Address, BUCKEYE ENGINE CO., Salem, O.

OR SALES AGENTS:

Buckeye Engine Company Agency, 10 Telephone Building, 18 Cortlandt Street, N. Y. A. A. Hunting, John Hancock Building, Boston, Mass. N. W. Robinson, 134 Washington St., Chicago, Ill. Robinson & Cary Company, St. Paul, Minn.

Combined Turn Tables & Motor

We want good Selling Agents for Store Fixture Novelties. Battery Motors surprise electrical experts. $10.00 per day made. Stamp for catalogue.

Equitable Engineering & Construction Company.

ELECTRICAL ENGINEERS AND CONTRACTORS.

ELECTRIC RAILWAY AND POWER PLANTS.

Drexel Building, Philadelphia, Pa., U. S. A.

W. A. STADELMAN, MANAGER-CHIEF ENGINEER.

WE WANT IT UNDERSTOOD FAR AND WIDE THAT

THE BALL ENGINE CO., OF ERIE, PA.,

HAS NOT EITHER REMOVED OR SOLD OUT, OR MADE OR SUFFERED ANY CHANGE in its line of production of STEAM ENGINES in consequence of the secession of former employees and the establishment of a rival factory.

BE IT KNOWN TO ALL WHOM IT MAY CONCERN THAT

THE BALL ENGINE CO., OF ERIE, PA.,

is a larger, livelier and more enterprising concern to-day than ever before; that its producing capacity has been doubled, and its mechanical and engineering departments greatly improved by the introduction of modern machinery and superior mechanicians.

Also, that it carries on hand, in such a state of advancement that quick delivery can be made, a large and well assorted stock of Single Cylinder, High Pressure, High Speed Engines, Cross Compound Engines and Tandem Compound Engines, all sizes, from 25 H. P. to 700 H. P.

E. T. COPELAND & CO.,

GENERAL EASTERN AGENTS,

No. 106 Liberty Street, N. Y.

DIXON'S GRAPHITE PAINT

ACTUAL EXPERIENCE

has shown that 1 lb. of DIXON'S GRAPHITE PAINT WILL COVER FROM TWO TO THREE TIMES MORE SURFACE AND LAST FROM FOUR TO FIVE TIMES LONGER than any lead, mineral or metallic paint. A tin or iron roof well painted will not require repainting for 10 to 15 years.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

BEST MAST ARMS IN USE.

MORE LAMPS TRIMMED. NO LAMPS BROKEN.

CATALOGUES ON APPLICATION.

STAR IRON TOWER CO., FORT WAYNE, IND.

Send for new American Electrical Directory. Just published—very complete lists—Invaluable for its information of Lighting and Railway Plants.

THE NATIONAL CARBON CO.

CLEVELAND, OHIO.

MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

AN UNQUALIFIED SUCCESS.

FIRST GENUINE SUCCESS EVER MADE IN THE GAS ENGINE FIELD.

We do not send an apology with our Engines—"we do not have to"—but we have all the other improvements of our competitors.

AND AN ADDITIONAL ADVANTAGE.

The Rollason Gas Engine will run an electric dynamo superbly (show us another that will), giving a perfect light without a flicker; turn them on or off by the dozen at your will, it's all the same.

Send for our Catalogue No 5, or, better, call at the warerooms and see three engines of different sizes in action.

ROLLASON GAS ENGINE.,

134 LIBERTY STREET, NEW YORK.

PERKINS INCANDESCENT TO FIT ALL SYSTEMS LAMPS TRADE MARK

THE PERKINS INCANDESCENT LAMPS.

CLAFLIN & KIMBALL Genl Agents 116 BEDFORD ST. BOSTON MASS.

NEW YORK—14 WHITEHALL ST. THE TUCKER ELECTRICAL CONS. CO.
PHILADELPHIA—806 WALNUT ST. O. D. PIERCE & CO.
CHICAGO—56 FRANKLIN ST. THE KNAPP ELECTRICAL WORKS.

UNIVERSAL ARC LAMPS.

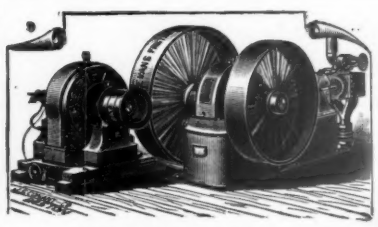
INCANDESCENT CIRCUITS.

They will burn in this position.

2 in Series,
6 to 8 Amperes,
100 to 120 Volts,
14 Hour Carbons,
No External Resistance.
A Perfect Arc Lamp.

For Central Stations, Isolated Plants and Electric Street Railways.

UNIVERSAL ARC LAMP CO., Office, 44 Broad Street, NEW YORK.

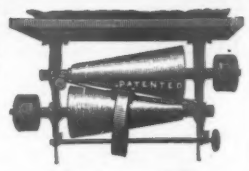


FOR DRIVING DYNAMOS.

THOUSANDS OF HORSE-POWER IN USE DRIVING DYNAMOS, and HUNDREDS of sets of Speed Cones, driving all classes of machinery where variable speed is desired.

FOR INFORMATION IN REGARD TO APPLICATION TO DYNAMOS SEND FOR CATALOGUE H, AND IN REGARD TO CONES FOR CATALOGUE X, TO

EVANS FRICTION CONE CO., 85 Water St., Boston.



EVANS CONES FOR VARIABLE SPEED.

OUR GOODS ARE SOLD BY

Alfred F. Moore, Philadelphia. The Thomson-Houston Electric Co., Boston. The Central N. Y. Electric Co., Syracuse. The Illinois Electric Material Co., Chicago. The Crowdus Chemical Electric Co., Memphis. Will & Fink, San Francisco, Cal., and from the factory, 420-426 East 25th street, N. Y.

***NOTHING BUT GUM** has yet been found reliable for INSULATING ELECTRIC WIRES. Don't put your trust in saturated fibre or reclaimed old shoes. We use the best GUTTA-PERCHA and PARA RUBBER, and IT PAYS BECAUSE IT LASTS.*

BISHOP GUTTA-PERCHA CO., 420-426 East 25th St., New York.

Whitmore and Robinson
Consulting Electrical Engineers
All kinds of Electrical Testing and Experimental Work
Permeability Measurements & Transformer Testing a Specialty
Office 133 Essex St. Boston.

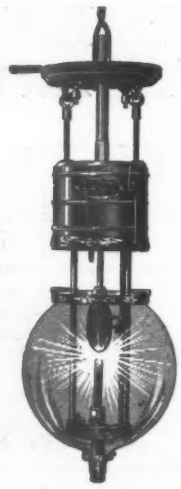
CROSBY STEAM GAGE AND VALVE CO.,

SOLE PROPRIETORS AND MANUFACTURERS OF

CROSBY POP SAFETY VALVES AND WATER RELIEF VALVES,
CROSBY IMPROVED STEAM GAGES and
CROSBY STEAM ENGINE INDICATORS.

Patent Gage-Testing Apparatus.

BOSWORTH FEED-WATER REGULATOR AND PRESSURE REGULATOR.
SOLE AGENTS FOR
Clark's Linen Fire Hose and Couplings.
MANUFACTURERS AND DEALERS IN
ENGINE BOILER AND MILL SUPPLIES.
Office and Works: BOSTON, MASS.
Branches: New York, Chicago and London, England.



ALL-NIGHT ELECTRIC LIGHTING.

The **"RUSSELL"** is the only single carbon lamp on the market that will accomplish this purpose successfully and economically, burning 12, 18 and 24 hours with a single trimming.

Send for one of the **"BABY RUSSELL"** lamps. The handsomest and smallest arc lamp in the world.

Extreme length, 27 inches, and only 23 inches from hanger board.

Foreign and domestic correspondence solicited.

WRITE FOR CIRCULAR No. 5.

RUSSELL ELECTRIC COMPANY,
85 Water Street, BOSTON, MASS., U. S. A.

AGENTS:

B. & S. Electric Equipment Co., 115 Broadway, New York, N. Y.
Illinois Electric Material Co., 158 Fifth Ave., Chicago, Ill.